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MTM

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March-April 1959

MTM ASSOCIATION FOR STANDARDS AND RESEARCH

MTM

The Journal of Methods-Time Measurement

March-April 1959

MTM Association

Editor. . . . . .Richard F. Stoll

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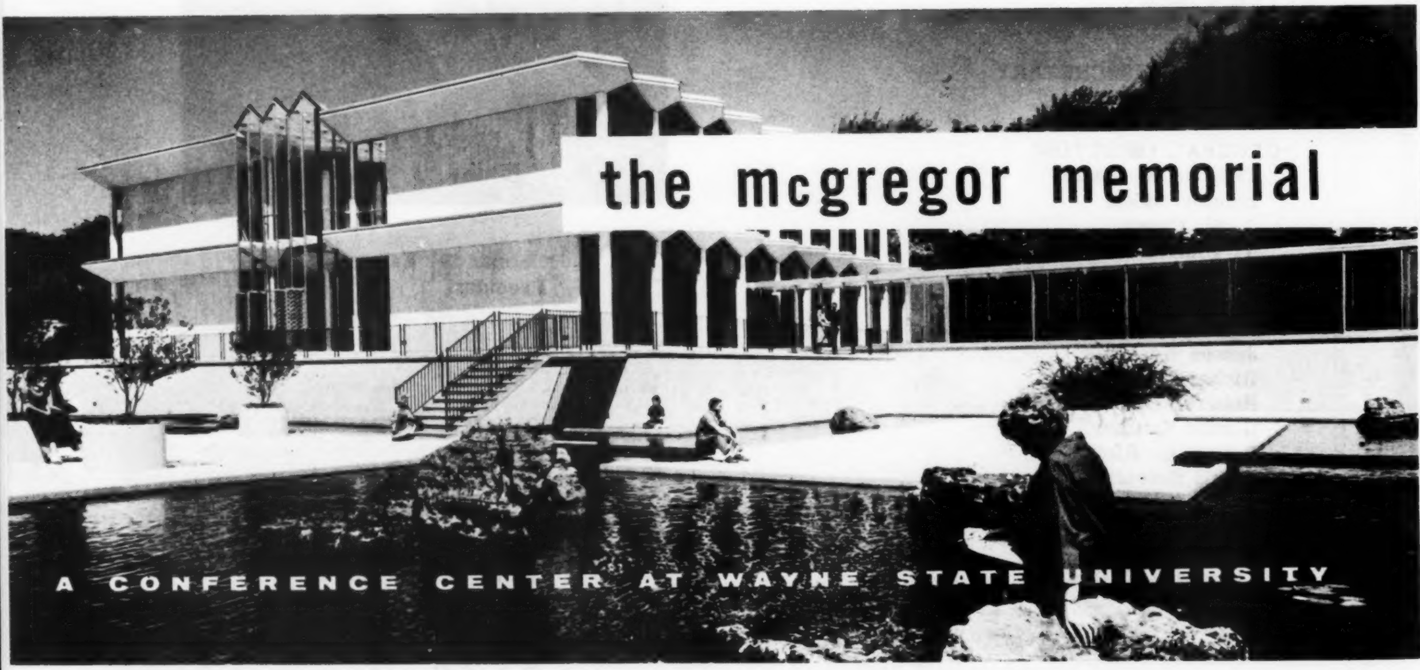

Detroit, Michigan

Here, in ten minutes' reading time, is a reappraisal of the study of organizational behavior — the strengths that have made it so popular, and the weaknesses that any one-sided approach always has. This is the twelfth in a series of articles designed to present a distillation of the best thinking on management subjects.

HUMAN RELATIONS — A SOBER SECOND LOOK

Human relations, which has enjoyed the almost unchallenged approval of businessmen and academicians alike for more than a decade, suddenly finds itself the victim of an ambush. Criticism and doubt are assailing both practice and theory from many quarters, and the road ahead looks just as treacherous.

Some of these assaults are extremely vigorous. "Too much emphasis on human relations," says one observer, "encourages people to feel sorry for themselves, makes it easier for them to slough off responsibility, to find excuses for failure, to act like children." Thus, the human relations specialists have been accused of promoting conformity, smothering tough-minded individualism, diverting the executive's attention from the job at hand, and melting away the nation's realism, will power, and courage. Other critics simply state that the well has run dry—that there has been no really new thinking since the first research studies over thirty years ago.

Thus the proponents of the study and practice of human relations are being forced to defend themselves. "Why is it," they ask, "that we are so persistently and stubbornly misrepresented by our antagonists? Why can't they—or won't they—see what it is we are really trying to do? Why don't they take the trouble to find out what this is all about, and stop judging the whole effort by the few quacks and hucksters who cluster around the lunatic fringe of a sound and expanding area of investigation and achievement?"

In the face of these attacks and counterattacks, the time has come, apparently, for a sober second look at human relations. Its moment of supremacy—which has some of the elements of a fad about it—is passing; stories of frustration and failure are beginning to come to light; and businessmen are starting to ask probing questions. Why did our human relations training program fall on its face? How come the trainees resisted it so much? Why was morale worse in my plant after I tried it than before? Why didn't my people respond as they were supposed to when I gave out that wonderful comic book presentation about how to get along with people? Should I blame human relations and the accompanying idea of teamwork for the lack of initiative and individual courage which I see in my junior executives?

One telling story going the rounds typifies this questioning and worry:

> A foreman in a manufacturing plant dutifully attended all the lessons in his company's human relations training program. A single thought imbedded itself firmly in his mind: you must treat your subordinates kindly, and show that you are interested in them as people. So the first chance he had, he tried out his new attitude toward the men on the line. He came in cheerfully at the start of the work day, and greeted each person with a pleasant "good morning," which was not his usual custom. To a man, his crew looked at him with suspicion, and then began to ask each other, "What is that old so-and-so looking for now? Probably the brass has been chewing him out and he's trying to get production up again. Well, the hell with him!" And he found himself at odds with his people until he reverted to his natural ways once more.

What Is "Human Relations"?

One of the real problems in the field today—and an often unrecognized source of the disputes—is the lack of a clear-cut definition of human relations. The words have come to assume such a broad meaning that almost anything can be included. Furthermore, leaders in different pursuits use the term differently. To the social workers, for instance, it means intergroup relations. When they ask "How can we improve human relations in this community?" they are thinking about the tensions and conflicts between white and colored, Catholics and Protestants, Yankees and Poles, "town" and "gown."

But to the businessman, and those who join him in his concern with the efficient operation of a commercial enterprise, the significance lies in the relationships between individuals in an organization. They break down the general term "human relations" into two parts:—the study of the field and the practice of a skill:

> The *study* of human relations is the attempt to find out how people act and react on one another as they work side by side in an organization. What do they do as individuals that diminishes or increases their own effectiveness—their own performance—and that of those with whom they are associated? Clearly, any such research leads back to the study of the individual personality, to the fears and hopes of men, because it is the fulfillment or frustration of these hopes and the easing or aggravating of these fears that shows itself in the day-to-day performance on the job. But the exploration of human relations is not primarily the clinical dissection of the specific human being—this is the role of the psychiatrist—except in that it has ramifications for what Joe does to Al that limits his creativity or his ability to do his assigned task.
>
> Human relations *skill*, on the other hand, is the implementation of the discoveries which are being turned up by the researchers. It is the ability to work effectively with others in a variety of different roles, and the successful welding of a number of people into an organization that can accomplish some goal.

It is this *skill* which has been the subject of most of the recent criticism. Few people question the wisdom of finding out why people act as they do, and what the relationships are that keep a company going or snarl it up. But the confusion arises over the question of what this skill really is, and to what ends it should be directed. Let us, then, take a closer look at human relations in this sense.

Skill at Human Relations

Everyone in a business enterprise finds himself in a series of constantly changing situations. One moment he is a member of a committee struggling to come up with an answer; the next he is the boss disciplining a subordinate. Later in the day his superior calls him in, and he himself is the object of criticism or evaluation. Still later he is observing, diagnosing, and then evaluating some problem which requires action; then he finds himself solving that problem by leading and influencing—even driving—those who are responsible to him. Or he may be filling the job of a coach or a teacher, bringing along a younger man and helping him to assume additional responsibility.

In other words, with the flick of an intercom switch his position may be transformed from boss to bossed; from taskmaster to coach; from leader to participant; from planner to doer. A man who is skillful in human relations can move from one to another of these functions, all of which involve interactions with other people, and do what needs to be done in each one effectively. In these terms, skill is measured by results rather than intent.

Furthermore, it is obviously not simply "being nice to people." There can be little doubt that the effort always to be nice to everybody, always to follow their wishes, is bound to fail—and a team of executives that tried to practice such a policy in the face of situations which demanded an altogether different approach would have real trouble running a business successfully. For example:

> One company was shocked to discover that an important division literally fell apart when its chief was transferred elsewhere. It had always moved smoothly, and management assumed that the people in it worked well together, that their relationships were solidly based. When they investigated, they discovered that the key to its apparent harmony had been held by the chief, who had gotten along with everyone beautifully on a personal basis but had kept the operation running through personal loyalty to him rather than with real skill at developing effective combinations of people who both understood and were productive in the jobs to which they were assigned.

Thus, human relations skill rests not on any single approach—neither being demanding or easy, sympathetic or rough, friendly or stern. Rather, it is the ability to deal with each specific situation as it arises in the fashion most appropriate to the people and issues involved.

The organization environment is most important in encouraging or impeding development of people. And human relations skill is addressed to opportunities to release and use more effectively the talents and energies of people in this context. The structure and dynamics of the job, the character of superior-subordinate relationships, the manner in which authority and accountability are conceived and exercised, the types of work experience, rhythms and pressures — affect not only communication and efficiency but also the development of people. The forces that make for the development of people also make for greater productivity.

It should be pointed out here that human relations skill, even when defined in this way, is not the only

ability which an executive has to demonstrate if he is to be effective. Obviously, he must know his job, and know the company; he must have technical competence. He has to be able to assemble facts, evaluate them skillfully, and act on them. He needs to be able to view the business as a whole, in the social and economic context within which it moves; as a marketing man, he has to understand the impact of his decisions on finance, production, personnel, sales; and so on. In the recent enthusiasm for human relations it has sometimes appeared that skill in this area is the only hallmark of a good executive. Undoubtedly the hard second looks now being directed at the field will make clear that it is one of many.

How can an executive successfully practice this particular skill? On what foundation does it rest? Technical competence depends on experience and the continuing effort to keep up with new developments in a particular specialty; the ability to see a whole enterprise is based on knowledge of the workings of the company and a cast of mind which can generalize and can appreciate the importance of other departments as a part of a common undertaking. But what are the elements that go to make up skill in human relations?

Attitudes and Know-How

One set of components comes under the heading of *attitudes*. It includes an understanding of human nature, with its conflict of emotions and motivations, its complex interweaving of strength and weakness, nobility and bestiality, selfishness and generosity, courage and cowardice. Thus, human relations skill requires an appreciation of the complexity and unpredictability of people and their actions, and the realization that countless influences are playing upon all of us.

It calls for a recognition—emotional as well as intellectual—that there are many different ways of looking at the same incident, that each man sees only a corner of an event, that other people's opinions and interpretations are just as valid to them as ours are to us. The successful practice of human relations is built on some understanding of ourselves, of our automatic reactions and impressions, of our biases and blind spots, of the way in which others see us. It demands a genuine concern and respect for the integrity and dignity of others, be they superior or subordinate, and an objectivity which makes it possible to shape an honest evaluation of an individual and his performance without passing omniscient, self-righteous moral judgments on him that hold true for every time and every situation.

Finally, real human relations skill depends on a sense of one's own integrity. As a leading educator has said, "A man's personal philosophy, his way of looking at the world and the men and women around him, determines his success as a manager of things and people more than any other single factor." A man who has no firm values, no tough-minded opinions, no operating philosophy of his own will find himself incapable of managing others. He will try always to be liked, will muddy the outlines of his convictions in the interests of "harmony," will tip over in the puffs and squalls of his associates' reactions. Conviction and independence of mind, of course, do not mean rigidity; rather, they provide a base from which a man can move as he discovers the need to do so. Flexibility, the willingness to be proved wrong, the ability to profit from mistakes demand some starting point. The manager who has no real views to start with cannot move forward from change to change; he just slops around from moment to moment, depending on the direction of the wind, waves, and tide. In so doing, he cannot act effectively with a group of people in changing roles in an organization; he simply reacts to them and to the pressures they place on him at the moment.

In addition to a set of attitudes, human relations skill depends upon some specific *know-how*. For example, a manager must be able to observe people in action, to perceive what they are really doing and saying, and how they respond to each other. He has to know how to be a spectator, how to find out what he wants to know, what to consider seriously and what to ignore. He has to be able to sort out the significant from the insignificant, to spot the tell-tale expression or word that gives him a clue to the hidden truth.

He needs to be able to diagnose a situation—to put together the facts he collects, and mark out the alternative possibilities. He has to evaluate people and circumstances, in order to determine the most advisable course of action. He needs to be able to listen, to encourage the expression of views. It has been estimated that an executive spends 80% of his time listening to others; but how much does he really hear and understand? He should know the kinds of behavior and response on his part which will cut off the flow of communication, and the types that stimulate it. He has to be able to accept criticism and advice without bristling or cringing; and needs to understand the barriers and gateways that arise between people when they are talking with one another.

Of course, these specific abilities are not enough for the executive if they stand alone. He needs the courage and the will to act on his diagnoses, and the flexibility to choose the appropriate kind of action. But they do help him to move more effectively when the time comes.

Obviously, a man must be a rare paragon to have all those attitudes and all those skills; and the fact is that many a more "ordinary" man often handles a human relations situation well without them—and often fails, too. The point is that these are goals to shoot for; the nearer they are approached, the more a man can raise his batting average and count on being consistently successful.

Can Human Relations Be Taught?

If skill at human relations depends both on attitudes and on specific know-how, can it be learned? Can you train people to be better at human relations; and if so, how?

Here is the nub of another great debate, which finds a number of experienced and able thinkers firmly on the side that human relations can't be taught. Either a man has the ability to work effectively with others, born in him and instilled by his family, his school, his church, his education—or he does not. Other specialists are equally convinced that people can be trained in this area, just as they can in more measurable fields. There are some rough generalizations, some hypotheses, some tentative laws of human behavior, and there is a body of knowledge on which to base some of the know-how which appears to be necessary.

Still others claim that human relations can indeed be taught, but only at certain levels of age, intelligence, maturity, or experience. They express real fear that the indiscriminate use of human relations programs may warp and confuse the student to the point where his dealings with others become introspective, self-conscious, contrived.

Many businessmen and teachers seem to have come to a conclusion which rests somewhere between these views. They are not sure whether—and how much—human relations skill can be imparted; they recognize that the study is less than a quarter of a century old in its present form. They go on to say that any education is a dubious process; that it is hard to measure, and hard to perform. But, recognizing their doubts, they feel that human relationships within a business enterprise are so important as a determinant of its success — particularly in hard times — that we must continue to make the attempt to equip men to operate more effectively with one another. We must continue to experiment, they say, until we find some way to build into ourselves the ability to join forces in a mutually beneficial manner.

But they tend to feel that there are similarities with the training required in any art: a bedrock of attitude and native talent is necessary, and some people are more trainable than others. Some children can be taught how to go over the keys on a piano and hit them in a prescribed order; some cannot even get that far. But some, with real talent, can learn to play musically and creatively if they are skillfully coached and willing to put in the work, pain, and sacrifice which are required. An appreciation of the beauty of music is not enough—though, of course, the right attitude helps. One must also have a trained eye and ear.

So it may be with human relations training. If a sincere and intelligent man understands other people's ways of thinking, and his own too, common sense will usually indicate the proper course of action; the difficulty is first to master the fundamental skill of understanding. One must be able to read the notes on the page of music and translate them into the proper keys on the piano. That takes know-how.

Of course, attitude and know-how cannot be so neatly divided. In fact, each depends on the other; the know-how without the basic attitude is insincerity and manipulation; the attitude without the know-how may wither from lack of fruitful expression. But the two are separate entities, nonetheless, and can be considered as such.

Granting that training in human relations can accomplish some objectives under the appropriate conditions, the pitfalls in the process are many. It is in courses of this kind that the worst confusion and misuse of the field have developed; for when human relations was a fad, quickie courses, lectures, and manuals were offered at random. It all looked so simple! Unfortunately, however, any training involves changing people's way of doing things, and the pictures of themselves and their work which they have in their minds. Consequently, it is a very tricky business indeed.

Some Brief Guides

Though successful and well-evaluated experience is still relatively rare, some general propositions are emerging:

Select and train your trainers carefully. One of the most complex areas of research revolves around this matter of how to prepare teachers of human relations. They are working with people's innermost beings, and too often are simply not adequately equipped for such a sensitive job.

Lectures and manuals are often ineffective. It is far easier to tell people about human relations than it is to change their practice of it. Guided student participation seems to be a *sine qua non*, possibly through role playing or case discussions in which the trainee can vicariously live in the situation himself. Cases on film, apparently, are especially useful.

Study materials must be realistic and related to the trainee's problems. The cases should deal with situations which are familiar to the students and close to their experience, or they will have trouble applying the lessons they have learned.

Quickie courses are almost sure to fail. There are no sure-fire gimmicks or gadgets, developed inside or outside a company, which will have meaningful impact. Indeed, these devices may tend to aggravate the

problems, since they often lay down a list of rules which are highly difficult to follow in practice. Victims of such "courses" may return to the job feeling frustrated and guilty because they cannot make the rules work.

Bottom-up planning of programs is a help. Instead of maintaining a management monopoly on the decision of what is needed, the trainees may profitably be asked to contribute. Training often signals the boss's dissatisfaction to the student ("If I were doing well," he thinks, "the boss wouldn't feel I needed this extra help") while joint planning permits both parties to uncover areas where help would be welcomed.

Don't expect quick results. Management sometimes panics at the first grumblings and sarcastic comments, and tosses the whole project overboard. This is still a pretty new sort of experience for many people, and the first days are likely to be disturbing. Furthermore, like any educational process, quick obvious results are the exception, not the rule.

The environment of the company is as important as the course itself. If the students come out of the program to find that the day-to-day conditions in the firm run counter to the attitudes expressed in this management-sponsored endeavor, they are likely to reject the training very fast and very cynically. "Training divorced from reality, involving principles which are constantly being violated on the job, is worse than useless," comments one specialist.

Beware of the misconceptions. Because the field of human relations has been so often misused, misunderstood, and misinterpreted by its opponents, its friends, and opportunists who have been riding high on a wave of enthusiasm, the ideas about it held by the students may get in the way of useful education. Management has to have a clear picture of what it means by human relations training, what its needs are, and what it hopes to accomplish, and it has to work with the students to get these across. Maybe a new name for the course would be of help here!

Conclusion

The field of human relations – or organizational behavior as some people prefer to call it—offers great possibilities. In an increasingly interdependent society characterized by large, complex projects which require cooperative effort, the degree to which human beings can learn to work together can truly be called the indispensable ingredient.

But "working together" does not mean sweetness and light. We do not want a nation of conformists, or an atmosphere of superficial and silly harmony created by men who are absorbed with the shallow goal of getting along with everyone. Rather, we have to develop ways to make people more independent, more self-confident, and better able, as dignified human beings, to work cooperatively with other equally mature and self-reliant human beings. If businessmen can use the research and skills of human relations to accomplish this objective, they will have made an enormous contribution to mankind—and one which far outreaches Sputnik in its long-range effects and implications.

Reprinted from the "ACME Reporter" 1957 Series - Number 3

"We wish to express our appreciation of the following from a Dutch contributor. In our opinion it is typical of the open-minded approach which has proven to be fertile ground for MTM application around the world."

J. Varkevisser,

Medewerker Adviesbureau voor Bedrijfsorganisatie Dr. Ir. M. G. Ydo,

Amsterdam

De invloed van het bewegingspatroon op de tijd per beweging

Het vaststellen van taaktijden kan op meerdere wijzen gebeuren: één der meest gebruikelijke methoden gaat uit van het grondtijdenprincipe. Hierbij wordt de bewerking, waarvoor taaktijden moeten worden vastgesteld, gesplitst in elementaire handelingen. Elementaire handelingen zijn brokjes van het werk, die telkenmale op dezelfde wijze terugkeren. Bij het confectienaaien zien we b.v. telkens:

- jaspand nemen
- jaspand op andere jaspand leggen
- lintje op naad leggen
- stof onder naald schuiven
- stof onder naald uit, draad afbreken

Zo zijn er uiteraard nog veel meer, maar het totale aantal is toch beperkt. Alle naaikarweitjes, die in een confectiebedrijf voorkomen, kunnen met behulp van deze elementaire handelingen worden beschreven. Wanneer nu voor iedere elementaire handeling de tijd wordt vastgesteld, nodig om hem uit te voeren, kan men met deze grondtijden voor alle naaiwerkjes de benodigde tijd berekenen, zelfs zonder het werk gezien te hebben.

Tegen deze werkwijze is theoretisch verzet gerezen, o.a. door William Gomberg in zijn 'A trade-union analysis of timestudy'. Dit verzet baseert zich vnl. tegen het zogenaamd op mechanische wijze achter elkaar schakelen van grondtijden: hierin ziet men een ontkenning van het totaliteitskarakter, dat ieder werk heeft voor de uitvoerder ervan. Men stelt daarbij dan, dat de duur van de elementaire handeling afhankelijk is van de plaats, die hij in de cyclus inneemt en van de structuur, die de werker door zijn individueel bepaalde werkwijze geeft aan het complex van elementaire handelingen.

Zoals men weet, is ook MTM een grondtijdensysteem. De elementaire handelingen zijn daarbij echter gereduceerd tot bewegingen en de overeenkomstige grondtijden tot waarden, die meestal liggen tussen 0,001 en 0,01 minuut. De bovengeschetste bezwaren, zo ze geldig zijn, zullen bij MTM nog veel meer invloed hebben dan bij andere toepassingen van het grondtijdenprincipe: het bewegingspatroon (zoals men het complex van achtereenvolgende en gelijktijdige bewegingen, nodig om een werk uit te voeren, wel noemt) is immers zeer fijn en ver geanalyseerd en iedere, ook maar zeer geringe oorzaak zal in staat zijn om de tijd voor de uitvoering der afzonderlijke bewegingen sterk te beïnvloeden.

Het is dan ook geen wonder, dat men getracht heeft om experimenteel na te gaan, of de genoemde theoretische bezwaren inderdaad gefundeerd zijn. Het experiment neemt daarbij meestal de volgende vorm aan: een beweging, die krachtens de uiterlijke omstandigheden volledig gelijk blijft, wordt binnen het bewegingspatroon tweemaal uitgevoerd, doch zodanig dat hij in de twee gevallen wordt vooraf gegaan en gevolgd door handelingen van zeer verschillende aard. Door meting van de tijdsduur der twee (uiterlijk identieke) bewegingen stelt men dan vast of de samenstellingen en uitvoeringswijze van het bewegingspatroon al dan niet van invloed zijn op de tijd der beschouwde beweging.

In 'Advanced Management' van februari 1953 is het resultaat van een dergelijk onderzoek gepubliceerd. De auteurs geven in hun artikel: 'Studies in relationships of therbligs' een overzicht van hun metingen. De resultaten dier metingen zouden, wanneer ze geaccepteerd moesten worden, desastreus zijn voor iedere toepassing van MTM of welk ander systeem van soortgelijke aard dan ook. Er kleeft echter één principieel bezwaar aan de uitgevoerde proeven: ze zijn gemaakt onder maximale inspanning van de proefpersonen. En wat geldig is bij max. inspanning, behoeft dit nog niet te zijn bij normaal werken, zoals we dat in de fabriek tegen komen.

Schrijver heeft dan ook een soortgelijk, zij het iets eenvoudiger onderzoek gedaan, teneinde na te gaan welke verschillen verwacht kunnen worden

bij normaal arbeidstempo. De uitgevoerde proef had de volgende inhoud:

Met de vinger een elektrisch contact indrukken, daarna reiken naar een pen, die reeds in een gat is gestoken. Deze pen beetpakken en ongeveer een cm omlaag drukken, tot hij tegen de onderkant stuit. Pen loslaten, reiken naar het elektrisch contact. Dit opnieuw indrukken en weer reiken naar de pen. Pen op dezelfde wijze beetgrijpen en in het gat omhoog bewegen, totdat een merkstreep op de pen gelijk staat met de bovenkant van het gat. Pen loslaten en weer naar het contact om dezelfde cyclus opnieuw uit te voeren.

In deze cyclus, die ongeveer 0,05 min. duurt komt viermaal een reikbeweging voor, die telkens gemaakt wordt onder identieke omstandigheden. Tussen het eerste paar reikbewegingen in vindt echter een ruwe en ongecontroleerde beweging plaats: het omlaagdrukken van de pen kan a.h.w. blindelings gebeuren. Tussen het andere paar réikbewegingen ligt echter een nauwkeurige en beheerste beweging: twee lijnen met elkaar gelijk leggen. Dit vereist visuele controle en goede oog-hand-coördinatie.

De tijden voor de verschillende bewegingen werden gemeten met een kymograaf. Dit is een toestel, waarbij door elektrische relais gedreven schrijfstiften tekens maken op een papierstrook, die met een snelheid van 5 meter per minuut voortloopt. De afstand tussen de gemaakte tekens staat in direct verband met de verstreken tijd: deze kan daardoor worden afgelezen met een foutenmarge van 0,0001 minuut.

Hieronder volgt het resultaat der proef: iedere gemeten tijd is het gemiddelde van 20 waarnemingen. De tijden zijn opgegeven in de bij MTM gebruikelijke TMU-waarde. Daarbij is één TMU gelijk aan 0,00001 uur. Behalve de

Beweging	Code	MTM-tijd	Gemeten tijd
Contact indrukken	M1A	2,0	2,8
*Reiken naar pen	R26B	11,7	12,8
Pen beetpakken	G1A	2,0	
Pen omlaag drukken	M1A	2,0	6,3
Pen loslaten	RL1	2,0	
Reiken naar contact	R26B	11,7	11,0
Contact indrukken	M1A	2,0	2,5
*Reiken naar pen	R26B	11,7	13,9
Pen grijpen	G1A	2,0	
Pen omhoog bewegen	M1C	2,0	
Merkstreep gelijk zetten	AP2	10,6	16,2
Pen loslaten	RL1	2,0	
Reiken naar contact	R26B	11,7	12,5
	Totaal	73,4	78,0

omschrijving der bewegingen is ook de bij MTM gebruikelijke codering opgegeven, benevens de officiële MTM-tijden.

Bij vergelijking van de 4 gemeten reiktijden blijkt, dat het reiken naar het contact in beide gevallen iets korter duurt dan het eraan voorafgaande reiken naar de pen. Het belangrijkste verschil is echter dat de reikbewegingen, waardoor de ruwe handeling 'pen indrukken' is omringd, inderdaad gemiddeld overeenkomen met de gestelde norm. De MTM tijd is 2 x 11,7 = 23,4 TMU en gemeten is 12,8 + 11,0 = 23,8 TMU.

De reikbewegingen, waardoor de beheerste handeling 'pen op merkstreep gelijk zetten' wordt omgeven, zijn echter substantieel hoger. Tezamen duren ze 13,9 + 12,5 = 26,4 TMU, wat 12% hoger is dan de normtijd. Hieruit volgt een belangrijke conclusie: wordt een handeling in de cyclus op behoedzame wijze uitgevoerd, dan heeft dit tot resultaat dat zowel de eraan voorafgaande als de erop volgende beweging langer duren, d.w.z. meer beheerst worden uitgevoerd. In MTM-termen gesproken betekent dat, dat de uitgevoerde beweging in de proef geen R26B doch een R26C was. De tijd voor zo'n beweging is 13,1 TMU. Brengen we dat in rekening, dan blijkt dat de MTM-tijd praktisch gelijk is aan de gemeten tijd: 26,2 TMU tegenover 26,4 TMU.

Uit de beschreven proef blijkt, dat de in den beginne genoemde bezwaren inderdaad bestaan. Ze zijn echter, althans bij het genomen experiment, van geringe invloed. Bovendien blijkt het mogelijk om ze bij MTM op te heffen door het gebruiken van een additionele toepassingsregel, die eenvoudig geformuleerd kan worden en door niemand misverstaan. Het experiment bevestigt aldus de bruikbaarheid van MTM en doet het vertrouwen in dit systeem toenemen.

[English translation follows.]

THE RELATION BETWEEN MOTIONPATTERN AND PERFORMANCE TIME OF THERBLIGS

J. Varkevisser

The use of standard data is one of the best ways to calculate the time, needed to perform an operation. When standard data are used for a certain class of work, this work is divided in small elements which repeat themselves regularly in all the operations belonging to the class of work under consideration. In his book "A trade-union analysis of time-study" Mr. Gomberg has attacked the standard data procedure by stating that those data do not form an additive set and that they are the result of atomistic psychological thinking, which does not take in account the influence of the operators personality and the way he is expressing himself in his work.

Now of course Mr. Gomberg is not the only one, supporting these views. There are other authorities in the field of motion and time-study, who have expressed their doubts about the validity of applying predetermined motion times on practical operations. That's why every practitioner of MTM (which is a standard data system too, the only difference being, that the MTM elements are smaller and more basic in nature than the elements of most standard data systems) should be very interested in experiments, proving whether he is right or wrong in assuming that the MTM elements form an additive set.

"Advanced Management" of febr.'53 contains a report by Nadler and Wray Wilkes on certain experiments in which the time was measured, needed for performing the motions in a simple repetitive cycle: pressing a button, reaching to a switch, turning the switch, reaching to the button, etc. This cycle was done, using switches of three different kinds, a definite stop type, a click type and a free moving type. The main result of the experiment was, that there was an appreciable difference in the performance time of the identical reaches to the different switches, which however were of identical exterior form.

When this result has to be looked upon as valid, one might better stop applying MTM. Fortunately there is one very important reason not to accept the figures given by the authors: during their experiments they had ordered their subjects to work as fast as possible. Now as industrial engineers working in industry we are not very much concerned with this type of experiments: we like to know whether MTM is accurate when it is applied to people working in a normal way, without undue haste or laziness.

To check whether the criticized statements were right, when a reasonable workpace was maintained, the writer did an experiment for himself. In this experiment a pin was used about 3/4" round and 4" long. This pin had a line drawn on his circumference. The pin was inserted in a hole and there was just enough friction between the pin and the hole to prevent this pin from sliding down by his own weight. At a distance of 10" from the pin there was a button, making an electric contact when pressed down.

The operation consisted of pressing the button, reaching to the pin, grasping it and moving it down 1/2" against the bottom of the hole. After releasing the pin the button was pressed again and the pin pulled out of the hole just to the point, where the line on its circumference coincided with the upper surface of the block in which it was inserted.

This cycle was performed 20x and the times for the different motions were measured with an accuracy of 0,0001 minute by a kymograph. The MTM-analysis, together with the averages of the measured times, are given below.

Motion	Code	TMU	Measured
Push button	M 3/4 A	2,0	2,8
Release button	R L 2	0,0	-
Reach to pin	R 10 B	11,5	12,8
Grasp pin	G 1 A	2,0	
Push pin down	M 3/4 A	2,0	6,3
Release pin	R L 1	2,0	
Reach to button	R 10 B	11,5	11,0
Grasp button	G 5	0,0	-
Push button	M 3/4 A	2,0	2,5
Release button	R L 2	0,0	-
Reach to pin	R 10 B	11,5	13,9
Grasp pin	G 1 A	2,0	
Move pin up	M 3/4 C	2,0	
Set line at the	A P 2		16,2
right height	(equiv.)	10,6	
Release pin	R L 1	2,0	
Reach to button	R 10 B	11,5	12,5
Grasp button	G 5	0,0	-
		72,6	78,0

In this cycle there are 2 reaches to the pin: one before making an uncontrolled and the other before making a highly controlled motion. Again there are 2 reaches after releasing the pin: one after an uncontrolled and the other after a controlled motion.

Type of reach	Con-trolled	Uncon-trolled	Differ-ence
Reach to the pin	13,9 TMU	12,8 TMU	1,1 TMU
Reach after re-leasing pin	12,5	11,-	1,5

From these figures it follows that there is without any doubt a relation between the time, needed to perform the reaches and the places that these reaches occupy in the cycle. However the difference is small and about the same as the difference between an R - B and an R - C.

A conclusion might be drawn from the experiment: when a highly controlled motion is performed the motions <u>before</u> and <u>after</u> the highly controlled motion are also more controlled and time-consuming than might be suggested by their exterior characteristics. R - C's were made in the experiment instead of R - B's. When these findings are confirmed by others, a new application rule might be developed: in selecting the class of Reach or Move take in account whether the motion before or after need careful handling and control.

MTM APPLIED TO CRIBBING AND UNCRIBBING USNX RAILROAD CARS USING UTILITY LOADERS

by

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This data was compiled because of the many U.S. Navy, Bureau of Ordnance installations, which used railroad cars with utility loaders.

The computation of the times for this data was derived by using MTM and by the actual performance of the operations involved.

There are two different operations included in this data—cribbing and uncribbing, or—loading and unloading.

Operations involving cribbing are as follows:

a. Adjust wall members to desired height as shown in Illustration III. The leveled time is shown in Table 3 of Formula M4-20.

b. Install cross members as shown in Illustrations IV, V, and VI. The leveled time is shown in Table 1 of Formula M4-20.

c. Install doorway members as shown in Illustrations XI and XII. The leveled time is shown in Table 2 of Formula M4-20.

d. Table 4 of Formula M4-20 is used when cross members are doubled or placed directly after each other to secure a large or heavy load.

3. Table 5 of Formula M4-20 is the leveled time per car for installing and removing dock board, preparing car for loading or unloading inert or explosive material, and opening and securing doors.

Many variables were encountered in this formula, mainly in the installation of cross members. To arrive at an average leveled time, the car was divided into tiers, five tiers in each end; the first tier being four feet from the end of the car; the second tier being eight feet from the end of the car, etc. Tier 5 is at the doorway.

To arrive at the leveled time for the average height, the cross members were installed. The car was divided into four different heights which are referred to as levels. It was found that the time to install a cross member at different levels did not vary much because the member would be raised or lowered to the installation height while it was being carried to the location. The time for the installation of each individual cross member was obtained, but after sufficient study, it was found that by averaging the times, the error would not be in excess of forty seconds on a complete car if forty cross members were used.

The leveled TMU's in all tables are the total TMU's for two operators. The Bureau of Ordnance does not allow only one operator to work alone in a remote area and two operators are normally required to handle the door and cross members.

Another variable was found in the allowed TMU's. When a car was loaded with an electric forklift truck, and the material was stowed palletized in the car, the forklift operator assists the other operator in moving the members only. The securing time is limited out by the forklift operator's time. This time is shown by a asterisk in Table I.

If ever a combination of members is desired other than shown in Table I, several different combinations can be added to arrive at the leveled time.

All the times in this formula are in TMU's with no allowance added.

Summary

CRIBBING AND UNCRIBBING 3000,4000 and 5000 SERIES USNX CARS WITH UTILITY LOADERS

PART:	USNX cars 3000, 4000 and 5000 series.
OPERATION:	Installing and removing door members, wall members, cross members, dock board, placards, flags and closing and opening doors.
WORK STATION:	USNX cars at buildings or magazines.

TIME FORMULA EXAMPLE

ALLOWED TIME: Table 1 + Table 2 + Table 4 + Table 5 + Allowances X .00001 = Des. Hrs/Car.
Des. Hrs. /Car. + No. of Units per car = Allowed Time/Unit. Allowances determined at each installation.

INSPECTION: No formal inspection - the operator must be certain that all members, doors, flags, and placards are properly secured and correct amount used.

PAYMENT: Day work

ALLOWANCES: Allowances for delays are not included in this formula. They are applied as the final step of the Application Sheet.

INSTRUCTIONS

A. The TMU values to install and remove cross members, wall members and door members at different height in the car have been averaged to obtain one TMU value.

B. This formula does not allow time for cross members to be installed or removed at the 9-foot level in the cars because cars of 3000, 4000 and 5000 series are used mostly for station use and the normal number used will not exceed 12 members, and 12 members can be stored at the 3-foot level in one end of the car without encountering a great deal of difficulty.

C. The bottom figure of TMU's for each car of Table I (shown with an asterisk *) does not allow the wrench time because when car is being loaded or unloaded with fork lift the other operator working the car shall have cross members loosened or tightened during fork-lift time.

D. The cross-member time as shown on Table 1 is the time for two men to handle cross members (one man at each end).

E. The door-member time as shown on Table 2 is the time for two men to handle door members (one man at each end). If the activities' policy is to have all door members stored in one of the cars, Table 2 will not be used too frequently since cars used for station shipping will seldom be loaded in the doorway. If the station's policy is to keep six members stored in the doorway, time will have to be allowed to handle six door members for every load; or if it is anticipated that the members will have to be moved for 1/2 of the cars loaded, then time could be allowed for three members which should average out over a period of time.

F. The time in Table 5, install explosive safety placards, is the time when a staple gun is used to secure placards to placard board.

G. Tiers - When the word "tier" is used in this formula, it refers to the different locations of cross and wall members throughout the length of the car.
   A. 1st tier is approximately 4 feet from either end of car.
   B. 2nd tier is approximately 8 feet from either end of car.
   C. 3rd tier is approximately 12 feet from either end of car.
   D. 4th tier is approximately 16 feet from either end of car.
   E. 5th tier is approximately 20 feet from either end of car or at the doorway.

H. Levels - When the word "level" is used in this formula it refers to one of four heights at which a member may be placed. The height may vary from 6 to 72 inches.

   The maximum number of members used in one tier in this formula is four. If more than four levels of cross members are used in one tier use Table I as follows:
   1. locate the respective tier from car diagram
   2. subtract tier with three levels from tier with four levels and use that TMU value for each additional member over four for both ends of car. Divide this figure by 2 for one end of car.

   Example
   A. Car Diagram 32, Column I = 12936
   B. Car Diagram 31, Column I - 10032
      2904
   C. 2904 is the time to install one additional member in each end of car at tier number four.
   D. 2904 divided by 2 = 1452 is the time to install the fifth member in one end of car in the fourth tier.

I. If explosive loaded car is partially loaded or unloaded in two or more days, use the TMU value for closing and opening an inert car for all days in excess of one day.

Example (Table 5)

A. Load car with explosives (open and close two doors)
B. First day the TMU value would be 15,672
C. Second day the TMU value would be 10,622
D. All days in excess of one day would be 10,622 multiplied by the number of days.

USE OF FORMULA APPLICATION SHEET

If the activity's policy is to leave cross members loose on floor near the doorway of empty car use Column I of Table 1 for loading and Column III of Table 1 for unloading.

If the activity's policy is to secure cross members in one end of empty car, use Column II of Table 1 for loading, and Column IV of Table 1 for unloading.

Read all instructions before using formula application sheet.

1. Locate car diagram to be used from Table I. Record the TMU value from proper column beside A on application sheet.

2. If door members are used, select one of the four conditions under location or destination. Locate the number of members to be used and read TMU value from Table 2 and record opposite B.

3. If reinforcing cross-members are used, select one of the four conditions that fits the situation under the tier number on Table 4. Select the number of members to be reinforced and read the TMU value from the table. The time values shown are values for the total number of members used. If four members are reinforced in each end (at the same tier position) then the time value would be read under the column for eight members. Record the time opposite C.

4. Circle the proper TMU value that fits the situation for loading or unloading under item D of application sheet and record in the time column.

5. Circle the proper TMU value for dockboard installation under item D of application sheet and record in the time column.

6. Total values A, B, C, and D in the time column of the application sheet.

7. Add activity allowance to total.

8. Multiply total TMU value by .00001 to convert to decimal hours.

9. Record the number of units per car under the allowed time.

10. Divide the allowed time in hours (item 3) by item 5 to obtain the allowed time in hours per unit.

ADDITIONAL INSTRUCTIONS

1. When one operator is assigned to work in a car continually by himself for loading or unloading by hand or when a fork-lift operator is assigned to unload a car with a fork-lift truck and loosens the cross members by himself but either man would require assistance in the removal or installation of the cross members in the TMU value for each individual operator may be obtained from Table 1.

As follows:

EXAMPLE: Car diagram No. 5, install from center of car.
Top TMU figure is 22884 ÷ 2 = 11442 TMU for the operator or the fork-lift operator assigned to the car.

Bottom figure (*) is 8124 ÷ 2 = 4062 TMU for the second man assisting the first. The two-man TMUs per car would be the sum of 11442 and 4062 or 15504. These times may be used quite frequently for balancing a production line where the man assisting the fork-lift operator, or the operator assigned to work in the car, has additional duties on the line.

PART: USNX Cars 3000, 4000 and 5000 series

OPERATION: Install and remove door members, wall members, cross members, dock board, placards, flags and seals, open and close door.

WORK STATION: USNX Cars at buildings or magazines

ALLOWED TIME: Table 1 + Table 2 + Table 4 + Table 5 + Allowances x .00001 = Dec. hrs/car Dec. hrs/car ÷ No. of units per car = allowed time/unit. (Allowances determined at each installation) (See Application Sheet.)

TIME FORMULA EXAMPLE

APPLICATION: This formula applies to the installation and removal of cross members, wall members, door members, dock boards, explosive placards, explosive flags and seals, and opening and closing doors.

This formula does not apply to installing and removing of cross members above a height of 72" and for using a jack to secure cross members. It also does not apply to cars in which the cross members, wall members and door members are in poor or damaged condition where excessive binding occurs.

ANALYSIS: A. Cross members: Cross members are used to secure loads of material in cars and extend from wall to wall. They are moved by two men, one at each end of the member. Cross members are secured or loosened by one man to or from the wall members by a latch. A box end wrench is used to tighten or loosen the cross members to the wall members. This wrench time is limited out when the cars are loaded or unloaded using a fork lift truck by the fork lift travel time. This allowed time is shown on Table 1 designated by an asterisk (*). The cross members are stored either on the floor near the center of the car or in one end of the car at a height of 30" to 54".

A reinforcing cross member is an additional member secured adjacent to another member. This is done to secure a heavy load. Members are installed or removed at different locations throughout the length of the car. These locations are defined as tiers. The tier location is as follows:

1st tier - four feet from the end of the car.
2nd tier - eight feet from the end of the car
3rd tier - twelve feet from the end of the car
4th tier - sixteen feet from the end of the car
5th tier - twenty feet from the end of the car or at the doorway.

TIME FORMULA EXAMPLE

SAMPLE - FORMULA APPLICATION SHEET

Installing or removing cribbing - USNX Cars 3000, 4000, 500 Series (Ref. OP 1750, First Revision, Utility Loaders	Set by: ________ Approved: ________ Date: ________

Desc. of Mat'l ____________________

Type: Explosive	☐	How Handled:	Loose	☐
Inert	☐		Boxed or Crated	☐
			Pallet	☐

Crew Size:

Two Men	☐
One Man and Lift-Truck Driver	☐
One Man (See additional instructions on page xi)	☐

Car Diagram Number (From Table I)

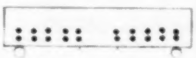
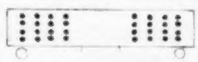
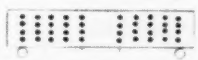
Activity		Reference Table	Reference TMU	TMU
A. Cross Member: Install or Remove		1		
B. Door Member: Install or Remove		2		
C. Reinforcing Cross Member: Install or Remove		4		
D. Loading: Doors Open and Close				
Explosive Load	One Door	5	12732	
Explosive Load	Two Doors	5	15672	
Inert Load	One Door	5	7382	
Inert Load	Two Doors	5	10622	
Unloading: Doors Open and Close				
Explosive Unload	One Door	5	11978	
Explosive Unload	Two Doors	5	17390	
Inert Unload	One Door	5	7382	
Inert Unload	Two Doors	5	10622	
Dock Board				
Install and remove by hand (Magnesium)		5	1626	
Install and remove with fork lift (Steel)		5	7790	

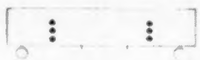
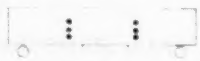
1. Total TMUs	
2. Allowance ______%	
3. Total Allowed TMUs	
4. Allowed TMUs x .00001	
5. Number of units per car	
6. No. 4 Divided by No. 5 Equals Allowed Time in Hours/Unit	

TIME FORMULA EXAMPLE

TABLE I

INSTALL AND REMOVE CROSS MEMBERS IN USNX CARS (SERIES 3000, 4000 and 5000)

Car Dia-Gram No.	Car Diagram and Location of Members	INSTALL Column I From Center of Car Total TMU	INSTALL Column II From End of Car Total TMU	REMOVE Column III From Load to Center of Car Total TMU	REMOVE Column IV From Load to End of Car Total TMU
1		5348 *2068	8668 *3418	4452 *1164	7458 *2208
2		10380 *3924	17018 *6638	8708 *2252	14740 *4360
3		14916 *5532	24872 *9582	12708 *3324	21826 *6536
4		19096 *6904	32390 *12330	16512 *4320	28814 *8674
5		22884 *8124	39464 *14874	20124 *5364	35570 *10980
6		8904 *4124	15316 *6874	7980 *3200	13952 *5710
7		17296 *7856	30122 *11758	15568 *6128	27542 *11178
8		24936 *11076	44176 *19930	22644 *8784	40680 *16434
9		31824 *13664	57736 *25688	29128 *10968	53456 *21448
10		39120 *16900	70544 *31014	35424 *13204	65842 *26212
11		12456 *6116	21966 *10678	11512 *5172	20804 *9516
12		24204 *11644	43224 *20768	22496 *9936	41086 *18630
13		34944 *16604	63474 *30090	32708 *14368	60640 *27256
14		44976 *20776	83014 *38822	42272 *18072	77656 *35464
15		54184 *24304	102554 *47794	51136 *21310	97996 *43236
16		16008 *8176	28614 *14390	14960 *7128	27424 *13300
17		31112 *15568	36324 *27994	29216 *13672	54334 *26004
18		44952 *21936	82770 *40574	42448 *19432	80180 *37984
19		57848 *27520	108310 *52368	54896 *24428	105252 *49333
20		69808 *32328	133850 *64402	66564 *29084	129502 *60054

Car Diagram Number	Car Diagram and Location of Members	INSTALL Column I From Center of Car Total TMU	INSTALL Column II From End of Car Total TMU	REMOVE Column III From Load to Center of Car Total TMU	REMOVE Column IV From Load to End of Car Total TMU
21		5032 *1864	8350 *3220	4256 *1088	7282 *2152
22		8392 *3732	14806 *6684	7588 *2928	13590 *5468
23		11748 *5528	21258 *10090	10924 *4704	20300 *9142
24		15104 *7396	27710 *13604	14256 *6544	26810 *12704
25		4536 *1608	7854 *2964	4000 *1072	7086 *2196
26		7640 *3220	14054 *6172	7076 *2656	13138 *5256
27		10740 *4760	20250 *9322	4152 *4176	19592 *8064
28		13840 *6368	26446 *12580	13232 *5760	25846 *11980
29		4180 *1372	7518 *2748	3804 *996	6988 *2218
30		7088 *2788	13520 *5758	6684 *2384	12776 *5014
31		10032 *4172	19540 *8732	9564 *3702	19034 *8226
32		12936 *5584	25540 *11794	12448 *5096	25072 *11326
33		3788 *1220	7074 *2544	3612 *1124	6756 *2226
34		6496 *2536	12848 *5326	6296 *2236	12386 *4864
35		9208 *3588	18642 *8074	8984 *3504	18358 *7790
36		11920 *4808	24402 *10896	11668 *4556	24250 *10744

INSTRUCTIONS

NOTE: The diagram of the cars illustrated above shows the members as being spaced at four-foot intervals throughout the length of the car. The time shown in TMU is the total time for two men to install or remove cross members as shown by the diagram. The time shown is man-TMUs.

1. Find the car diagram that fits the situation. For a diagram not shown car diagrams may be combined.
2. Take the allowed time from the proper column of the table. (see below)
   A. Top figure is total TMUs for two men when car is hand loaded or unloaded.
   B. Bottom figure (with asterisk *) is total TMUs for two men to load or unload car when one of these men is a fork-lift operator and assists in the handling of the cross members.
3. When two diagrams are used for different ends of car, add the total TMUs for both car diagrams and divide by two for the total TMUs for the combination car.
4. When cross members are used in the doorway of a car, the TMU time is the same time that is required for the fifth tier. (tier at the doorway)

4. (continued)
   Therefore, several different car diagrams may be used to obtain the total time.

   EXAMPLE: Car Diagram Number 5 Column I = 22884 TMU
   Car Diagram Number 5 Column I = 3788 TMU
   TOTAL 26672

   So the required time to install 10 cross members at one level (Car #5) and 2 cross members in the doorway (car #33) for a total of 12 members would be 26672 TMUs.
5. When cross members are doubled (that is a second member placed directly behind the first member for reinforcing, use Table #4.
6. Explanation of each column
   A. Column I is the time required for two men to install cross members when the members are lying loose on floor near doorway of car.
   B. Column II is the time required for two men to install cross members when members are secured in one end of car between the height of 2 1/2 to 4 1/2 feet.
   C. Column III is the time required for two men to remove cross members and place members on the floor near the doorway.
   D. Column IV is the time required for two men to remove cross members and reinstall cross members in one end of the empty car between the heights of 2 1/2 to 4 1/2 feet.

TIME FORMULA EXAMPLE

Formula No. M4-20

TABLE 2

DOOR MEMBER, REMOVE, MOVE AND INSTALL
DERIVED FROM CHART C

Location or Destination	No. of Door Members Used or Moved									
	1	2	3	4	5	6	7	8	9	10
Remove from Door and Install in Opposite Door	505	1,010	1,515	2,020	2,525	3,030	3,535	4,040	4,545	5,050
Remove from Door, Place on Floor, Get from Floor, Install on Same Side	679	1,358	2,037	2,716	3,395	4,074	4,753	5,432	6,111	6,790
Remove from Door, Place on Floor, Get from Floor, Stack in End of Car	4,852	9,704	14,556	19,408	24,260	29,112	33,964	38,816	43,668	48,520
Remove from end of Car, Place on Floor, Get from Floor and Install in Door	5,002	10,004	15,006	20,008	25,010	30,012	35,014	40,016	45,018	50,020

The TMU value for the number of door members equals the time to remove, install, or remove and install door members according to the destination or location.

Formula M4-20

TABLE 3

ADJUSTING WALL MEMBERS IN USNX CARS 3000, 4000 and 5000
SERIES, AVERAGE ADJUSTMENT IS 10 INCHES. DERIVED FROM
CHART B

Tier No.	No. of Levels or Members			
	1	2	3	4
1	538	769	1,017	1,265
2	508	739	987	1,235
3	448	679	927	1,175
4	418	649	897	1,145
5	358	589	837	1,085

NOTE: The time values shown in Table 3 are generally limited out. See synthesis. However, the table has been included in case it is necessary to use the time values. Application of table: The values shown are the Man-TMUs to adjust one to four wall members per tier on one side and one end of car. If wall members are adjusted for more than one tier, the time values for the various tiers must be added. The time values doubled will give the time to adjust wall members on both sides of car. And that value doubled will give the time for the entire car.

Formula M4-20

TABLE 4

INSTALL AND REMOVE REINFORCING MEMBERS

Tier No.	Number of Reinforcing Members 1	2	3	4	5	6	7	8
Install - Members Stored in Center of Car								
1	889	1777	2666	3554	4443	5331	6220	7108
2	840	1679	2519	3358	4198	5037	5879	6716
3	776	1551	2327	3102	3878	4653	5429	6204
4	730	1459	2189	2918	3648	4377	5107	5836
5	678	1355	2033	2710	3388	4065	4743	5420
Install - Members Stored in End of Car								
1	1662	3324	4986	6648	8310	9972	11634	13296
2	1614	3227	4842	6454	8070	9684	11298	12912
3	1550	3099	4650	6198	7750	9300	10850	12400
4	1502	3004	4506	6008	7510	9012	10514	12016
5	1444	2888	4332	5776	7220	8664	10108	11552
Remove - Members Store in Center of Car								
1	876	1751	2627	3502	4376	5253	6129	7004
2	834	1667	2501	3334	4168	5001	5835	6668
3	770	1539	2309	3078	3848	4617	5387	6156
4	721	1441	2162	2882	3603	4323	5044	5764
5	672	1343	2015	2686	3358	4029	4701	5372
Remove - Members Store in End of Car								
1	1672	3344	5016	6688	8360	10032	11704	13376
2	1628	3255	4883	6510	8138	9765	11393	13020
3	1564	3127	4691	6254	7818	9381	10945	12508
4	1524	3047	4571	6094	7618	9141	10665	12188
5	1458	2916	4374	5832	7290	8748	10206	11662

Reference: Tables G, H, J, and K

Formula M4-20

TABLE 5

OPEN AND CLOSE CAR DOORS, INSTALL AND REMOVE DOCK BOARD, INSTALL AND REMOVE EXPLOSIVE PLACARDS, INSTALL AND REMOVE EXPLOSIVE FLAGS

Chart Letter	Type of Material Loaded or Unloaded	Column I Total Two Man TMUs When One Door is Opened or Closed	Column II Total Two Man TMUs When One Door is Opened or Closed
I	Explosive Material Unload	11978	17390
J	Explosive Material Load	12732	15672
K	Inert Material Load	7382	10622
L	Inert Material Unload	7382	10622
K39	Install and Remove Magnesium Dock Board by Hand (K39 x 2 Men)	1626	1626
K53	Install and Remove Steel Dock Board With Fork Lift (K53 x 2 Men)	7790	7790

NOTE: Column I time, allows time to open and close one door of car
Column II time, allows time to open and close two doors of car

INSTRUCTIONS:
1. Select the type of material (inert or explosive) and if loading or unloading.
2. Take the TMU value from the proper column of the table.

ILLUSTRATION I

RACK-TYPE LOADER

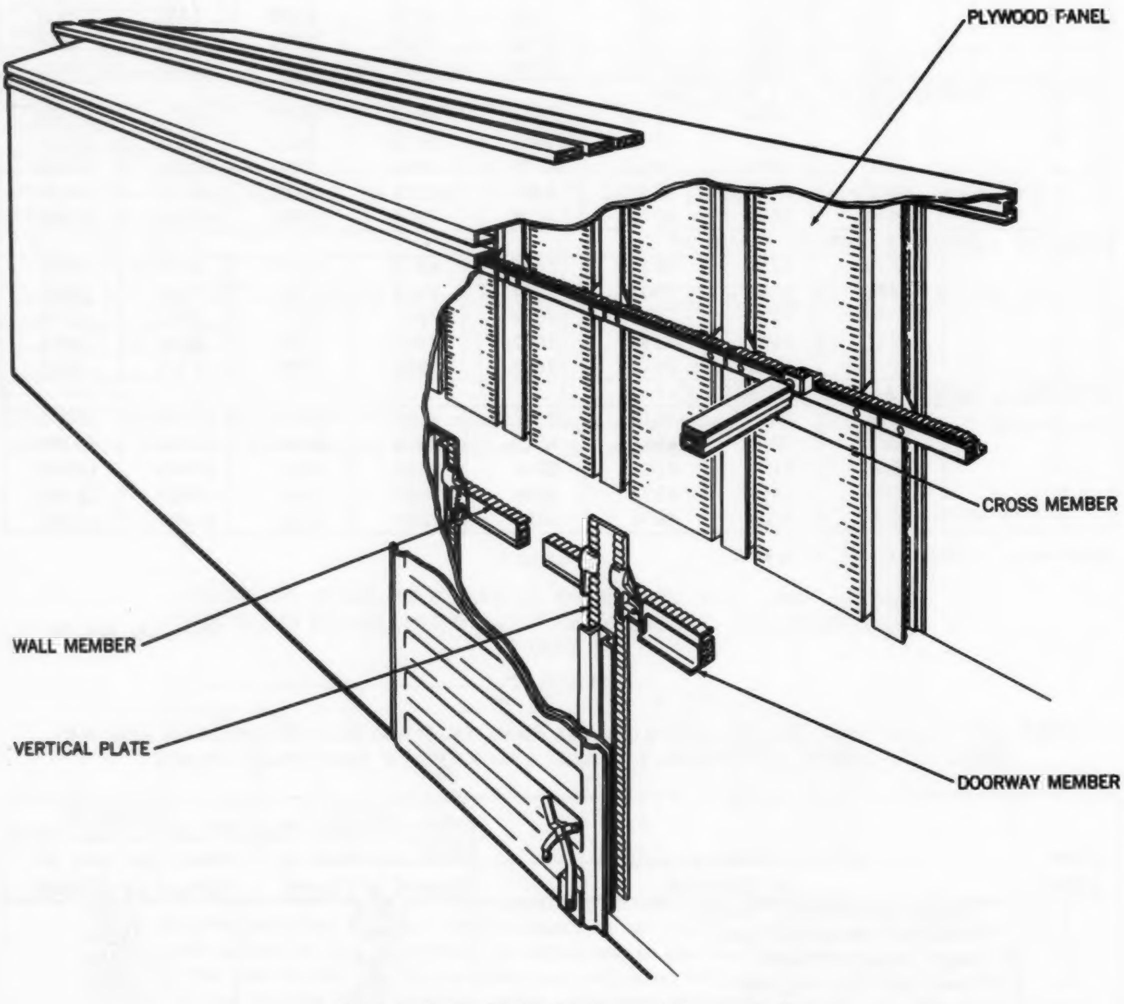


Figure 1—Rack-Type Loader-General Arrangement

GENERAL ARRANGEMENT

The rack-type loader (fig. 1) consists primarily of steel vertical plates supporting wall and doorway members to which cross members that lock the load in place are mounted.

TIME FORMULA EXAMPLE

ILLUSTRATION II

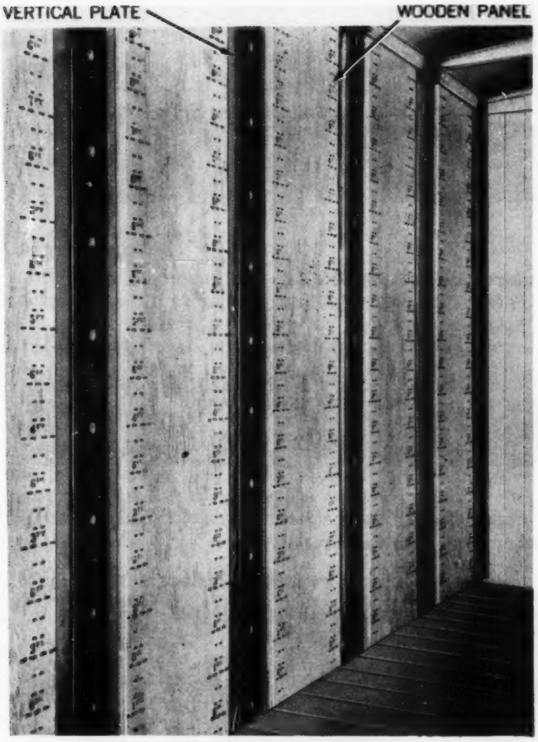


Figure 2—Vertical Plates

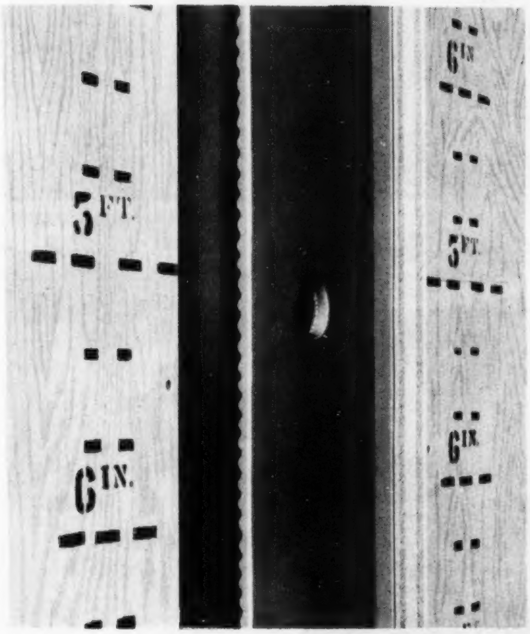


Figure 3—Details of Vertical Plates and Wooden Panels

VERTICAL PLATES AND WOODEN PANELS

Vertical plates are welded to the car sides at regular intervals (fig. 2). Corrugated racks extend along the inner edges of each vertical plate. These racks are mated with racks on the wall and doorway member hangers to hold the members in the car at any desired height.

A wooden panel is located between each two vertical plates (fig. 3). These panels are stenciled with height marks at two-inch intervals. When installing wall members, align with corresponding stencil marks on the wooden panels.

WALL MEMBERS

The wall member consists of a length of angle iron with corrugated racks fastened to the top, a wooden rub rail extending along the lower front edge, and two hangers welded at the rear. A latching device is located at the lower right side of the wall member. The racks locate and hold cross members. The wooden rub rail presents a non-metallic bearing surface to the load. The hangers locate and hold the wall member to the vertical plate. The lock anchors the wall member to the plate. Two types of locks are used. Figures 4 and 5 show a latch-type lock, and figure 6 shows the plunger-type lock.

Figure 5 shows the latch-type wall member. The spring-loaded latch must be held in the retracted position (fig. 4) before the wall member can be inserted into the opening between the plywood panel and vertical plates. When the wall member is in position, the latch is released and allowed to spring into its normal extended position (fig. 5) behind the vertical plate, thus locking the wall member to the vertical plates.

The plunger-type wall member (fig. 6) is identical to the latch-type member except for the locking arrangement. In this case, a plunger connected to a locking lever serves to secure the member to the vertical plate. When the member has been positioned, the lock lever is released and the plunger springs behind the plate racks to lock the wall member in place. Installation procedure for latch- and plunger-type wall members is the same.

Hold the wall member near each end (fig. 7). Retract the lock latch or plunger with the right hand. Tilt the member, and insert the hangers between the vertical plates and the wooden panel. Referring to the stenciled height marks on the plywood panel, level the wall member. Drop the bottom edge to engage the wall member hangers with the vertical plate racks. Release the lock latch or plunger, allowing it to spring behind the vertical plate to anchor the wall member in place.

In figure 8, the operator has retracted the latch or plunger, inserted the member at an angle, leveled it, dropped the bottom edge, and released the latch or plunger.

TIME FORMULA EXAMPLE

ILLUSTRATION III

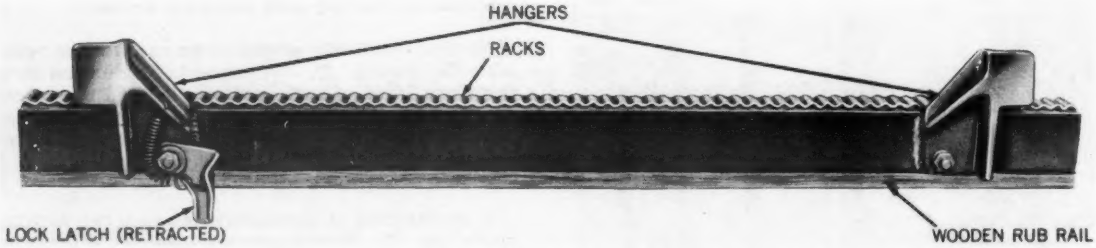


Figure 4 — Rear View of Wall Member-Lock Latch Retracted

Figure 5 — Rear View of Wall Member-Lock Latch Extended

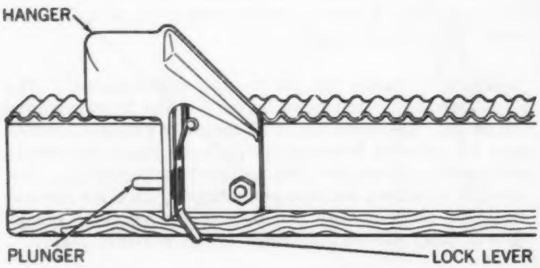


Figure 6 — Rear View of Plunger-Type Wall Member

Figure 7 — Wall Member Installation-Positioning the Member

Figure 8 — Wall Member Installation — Member Locked in Place

ILLUSTRATION IV

Figure 9— Cross Member

CROSS MEMBERS

The cross member (fig. 9) is the unit that locks the load in place. It is held in position by the wall members and the doorway members. The cross member consists of a steel frame with a Z-shaped cross section, two wooden rub rails on either side of the frame, and two end joints.

One end joint of the cross member is fixed; the other is an expansion joint (fig. 10). This expansion joint may be moved in or out as necessary to obtain the proper length for installing the cross member to the wall members. Locking arrangements of both joints are the same.

Figure 11 is a view of the underside of a cross member end showing the locking cam in the "OPEN" position.

Turning the locking nut on top of the cross member to the "LOCK" position (fig. 12) forces the cam out. When the wall and cross members are in place, this action slides the cam under the lip of the wall member and locks the cross member to it.

Figure 13 shows how the corrugated racks are mated. The cam is positioned in the "LOCKED" position to make it impossible for the members to be separated. To unlock the members, turn the locking nut until its arrow is pointing in the direction marked "OPEN."

After making certain that both cam-locking nuts are "OPEN," hold the member near its center to balance the weight (fig. 14).

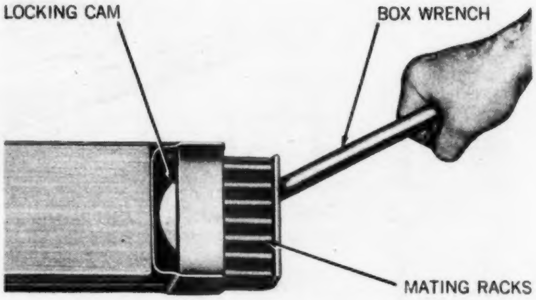


Figure 11—Cross Member Locking Cam OPEN

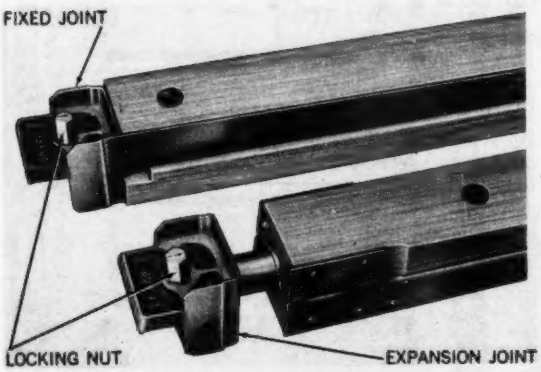


Figure 10— Cross Member Ends

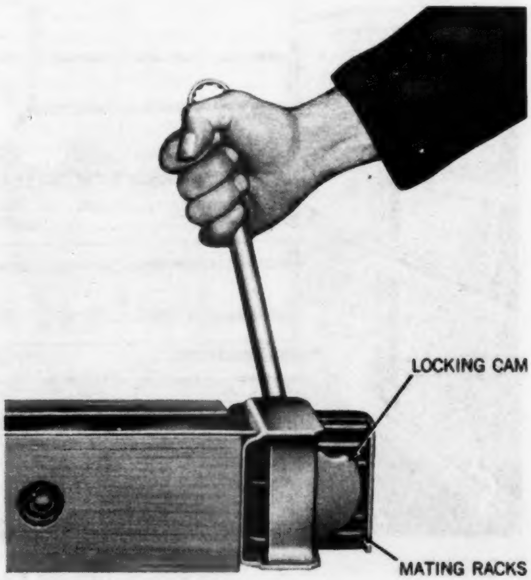


Figure 12—Moving Cam into LOCKED Position

ILLUSTRATION V

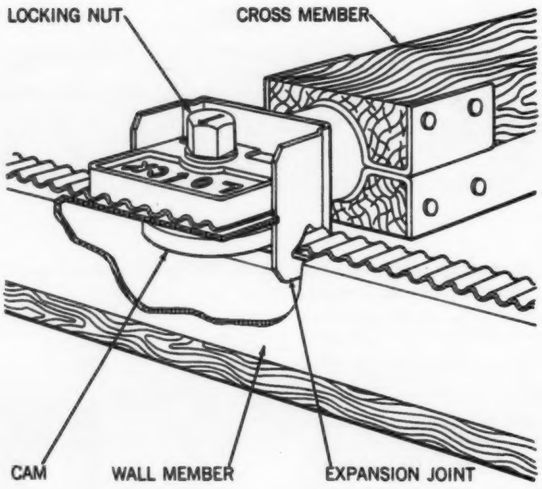


Figure 13—Cross and Wall Members Locked Together

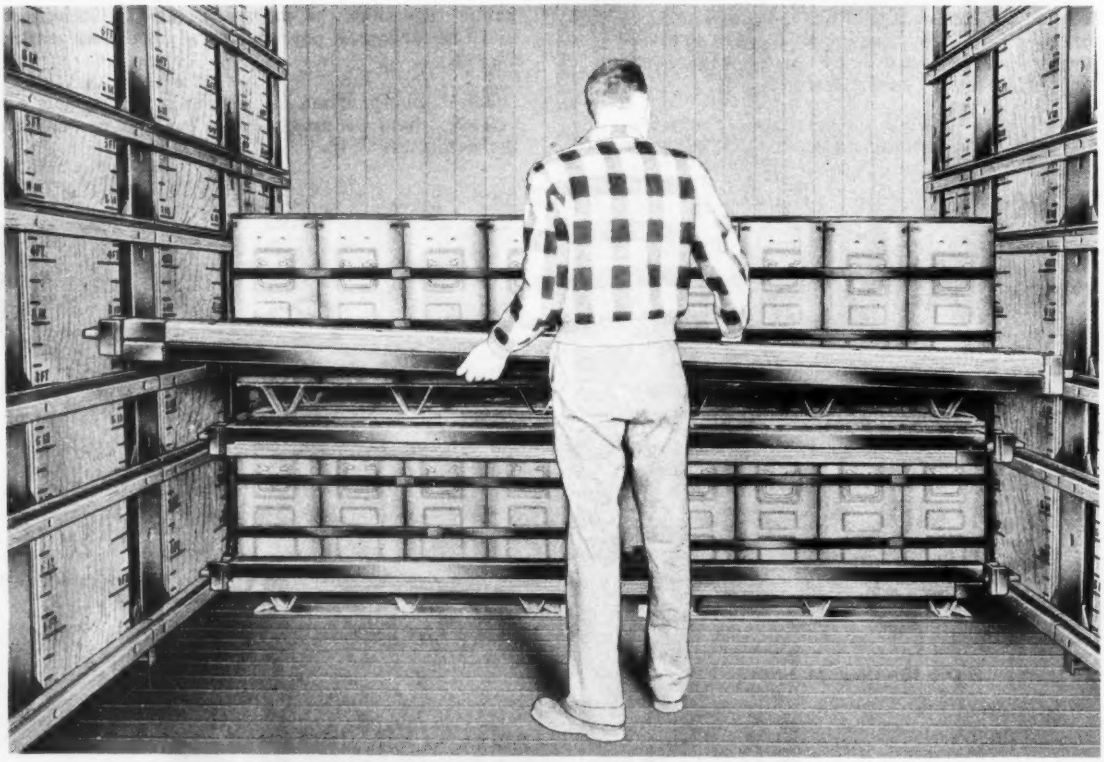


Figure 14—Cross Member Installation—Holding the Member

ILLUSTRATION VI

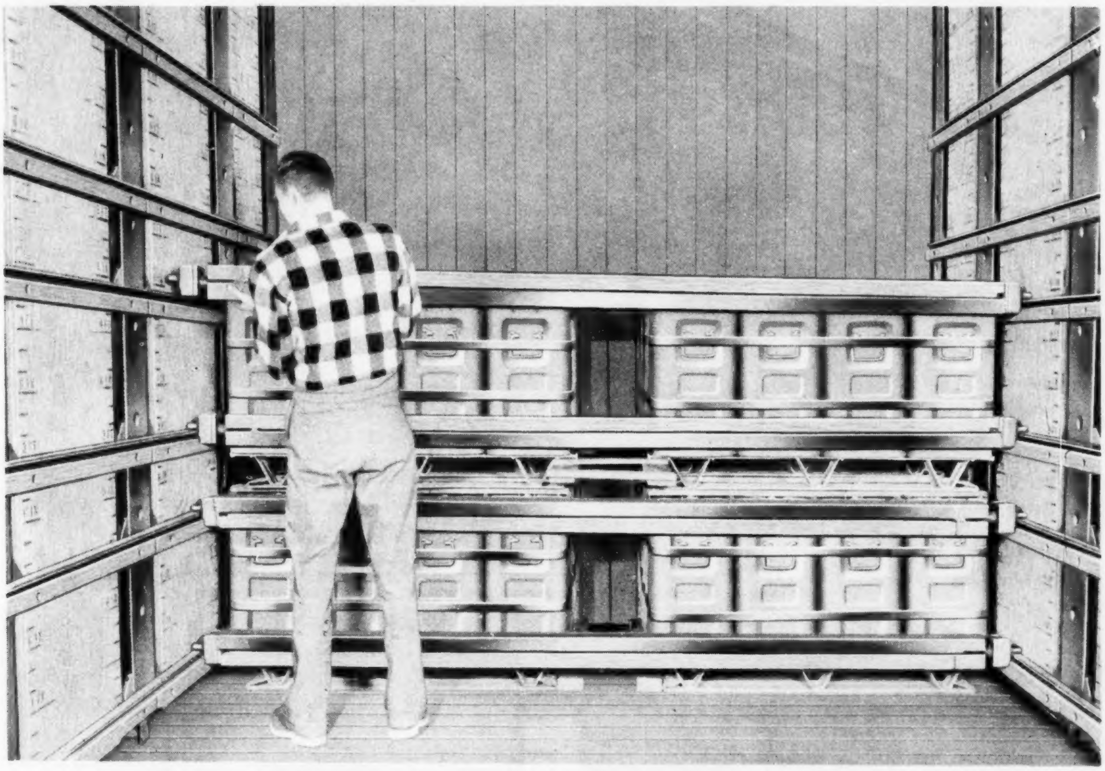


Figure 15—Cross Member Installation—Positioning the Member

Rest the fixed end of the cross member on the wall member racks (fig. 15). Move the expansion joint on the other end, as necessary to obtain the proper length, and seat this end on the wall member racks.
NOTE: Make sure that the cross member rests against the load. Jack the member firmly against the load (fig. 19), and lock it (fig. 20) by turning the locking nut until its arrow and the arrow on the end joint are pointing toward each other.

Figure 16 shows the palletized load locked in place by the cross members. Each cross member is held in the correct, level position by properly aligned wall members.

LOAD JACK. The load jack (fig. 17) is a tool for snugging cross members firmly against the load. It works much like the socket-wrench ratchet. After engaging the jack pawls, the operator can "walk" the jack on wall member racks by applying force to the lever.

The load jack contains three gears keyed on a common shaft, two pawls, and a lever (fig. 18). The turning gear receives force from the lever through the turning pawl. The holding gear, engaged with its pawl, prevents the jack from slipping while the lever is being returned into position for the next power stroke. The tightening gear, mated with the wall or doorway member racks, moves the jack against the cross member.

TIME FORMULA EXAMPLE

ILLUSTRATION VII

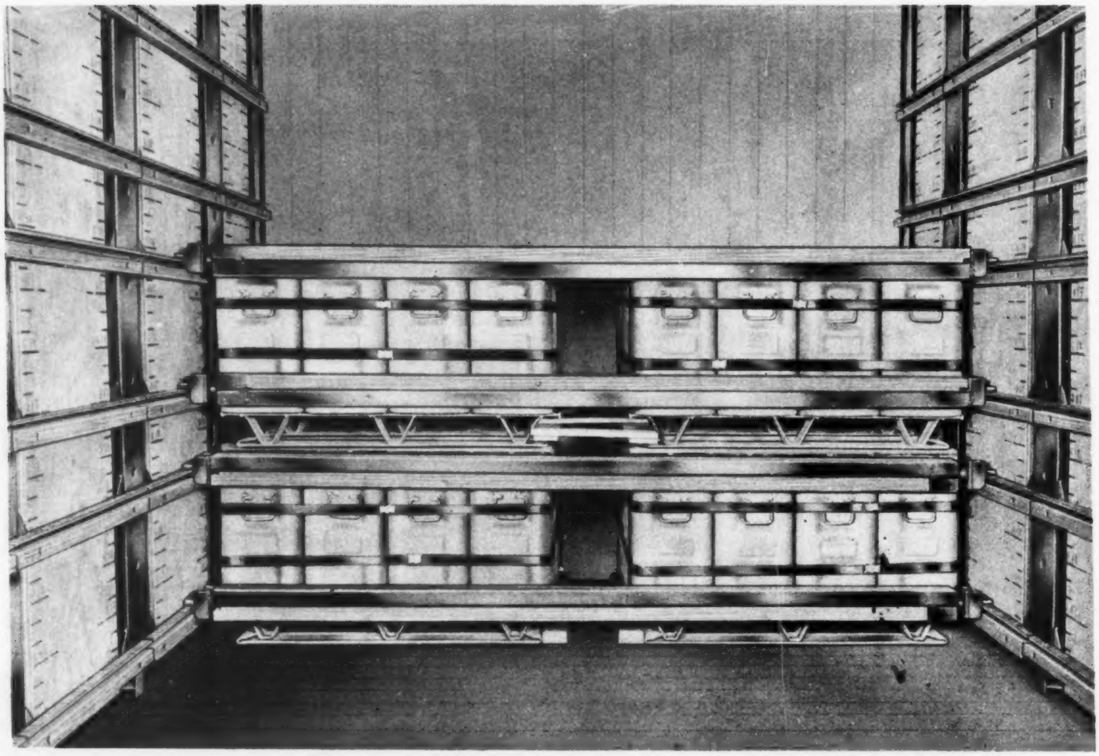


Figure 16—Cross Member Installation—Members in Place

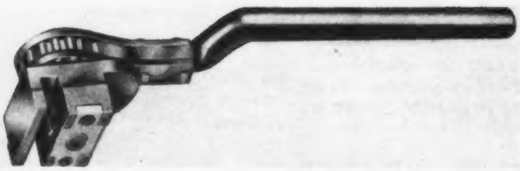


Figure 17—Load Jack

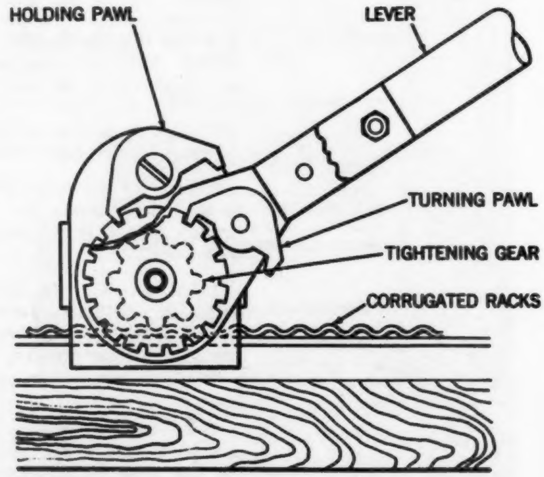


Figure 18—Load Jack Details

ILLUSTRATION VIII

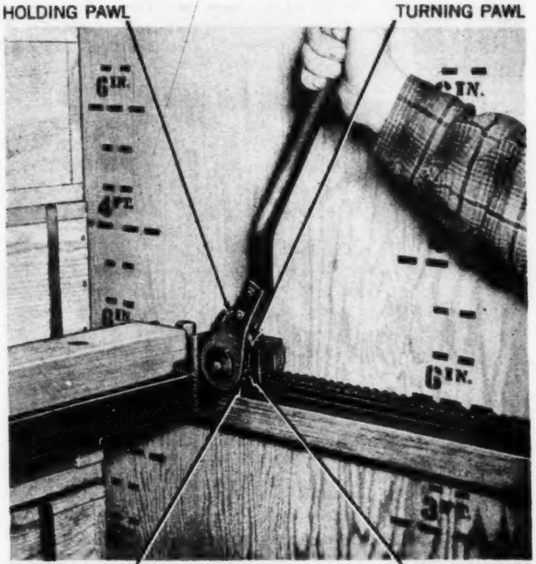


Figure 19—Jack in Operation

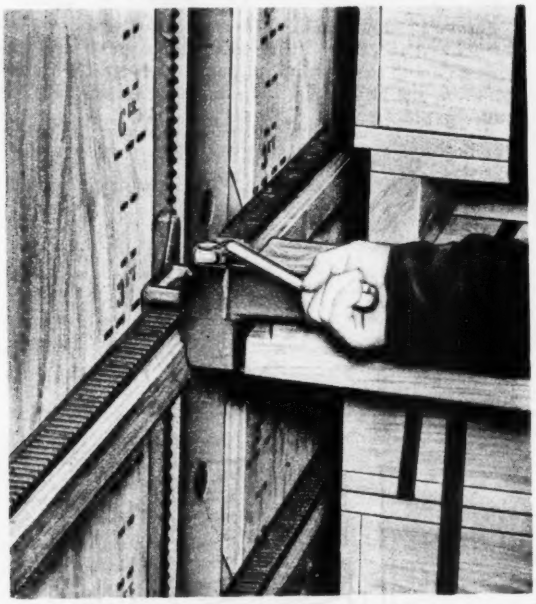


Figure 20—Locking Cross Member Against Load

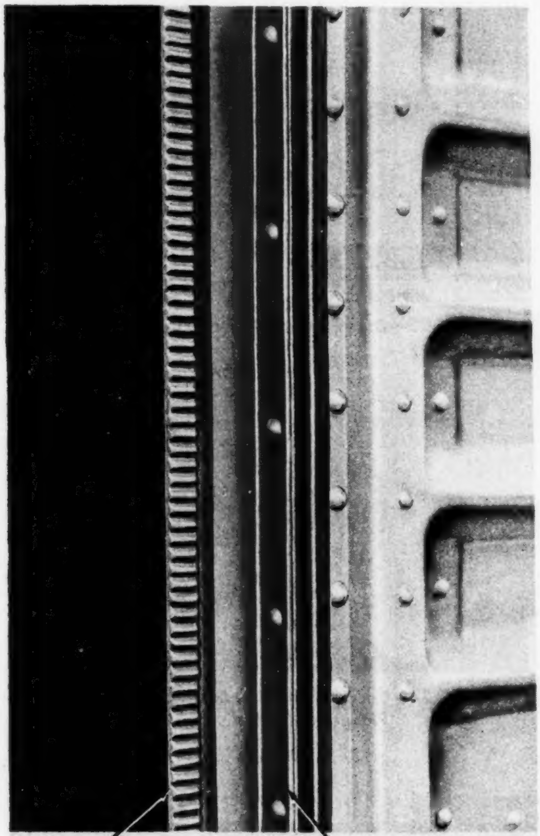


Figure 21—Doorway Rack Arrangement

Slide the load jack onto the wall member against the cross member to be tightened (fig. 19). Engage the front ends of the two pawls with the teeth of the turning and holding gears, respectively. Apply force to the lever.

When one end of a cross member has been jacked against the load (fig. 19) and its racks are meshed with the wall member, it is ready to be locked. Place a wrench over the locking nut, and turn until the "LOCKED" position arrows on the nut and on the end joint are pointing toward each other (fig. 20).

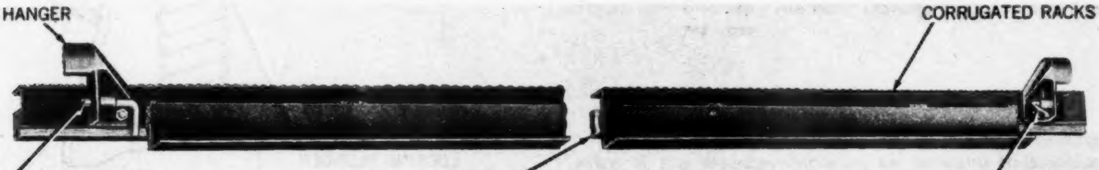


Figure 22—Doorway Member

ILLUSTRATION IX

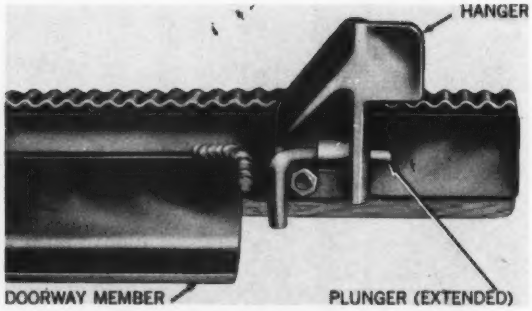


Figure 23—Doorway Member Locking Arrangement

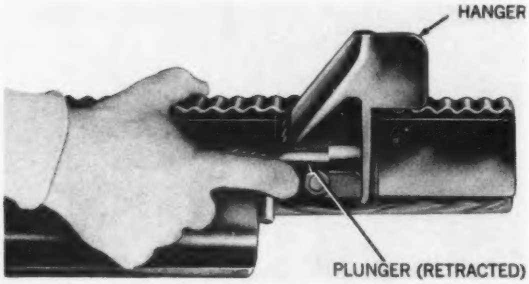


Figure 24—Doorway Member Locking Arrangement—Plunger Retracted

NOTE: Do not remove the jack until the cross member is locked against the load. The jack in figure 20 has been removed to show the locking nut engaged by the wrench.

DOORWAY MEMBERS

Doorway racks (fig. 21) extend along both outer edges of each car-door opening. They hold the doorway members which provide for cross member installation across the car openings.

Doorway members (fig. 22) are held to the vertical plates, on either edge of the door opening in the same manner as wall members. They are locked in place by plungers which extend behind the vertical plates. The doorway members are removable from either the inside or the outside of the car.

Both ends of the doorway member have identical plunger-type locking arrangements (fig. 23). The plunger is held extended by a spring in the plunger housing. This plunger, when extended behind the engaged racks, holds the doorway member firmly in position.

The doorway member is unlocked for removal or installation by pulling back the plunger (fig. 24) at each end. Note that the hanger is identical to those found on wall members.

Figure 25 shows the reverse side of a doorway member locked in place. The locking plungers are extended behind the vertical plates to prevent the member from tilting outward and disengaging its hangers from the plate racks.

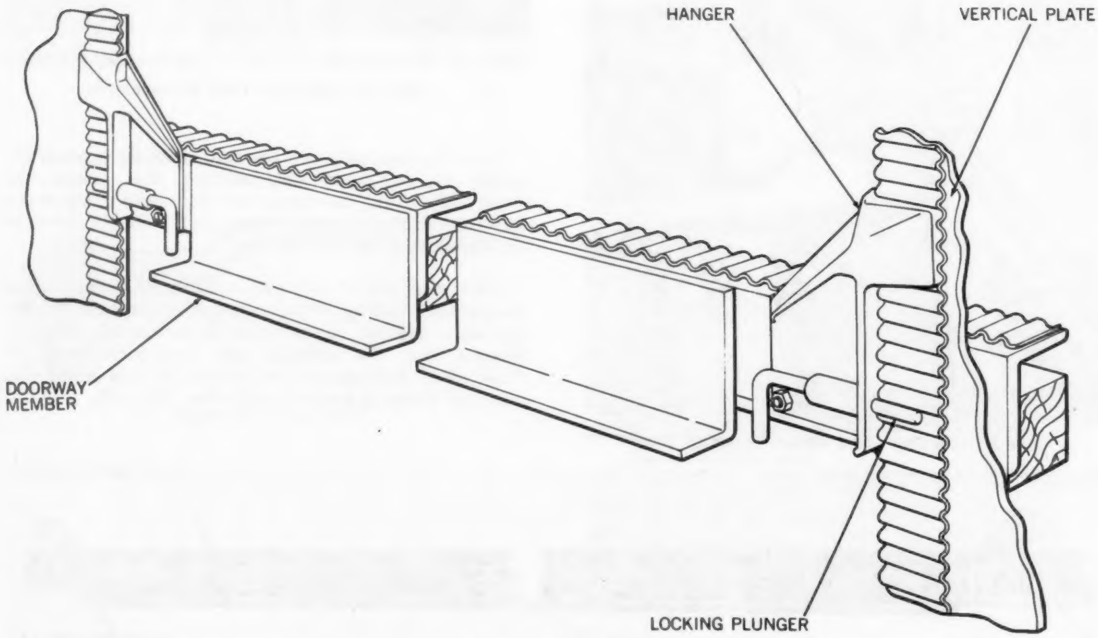


Figure 25—Doorway Member Mated with Vertical Plate

ILLUSTRATION X

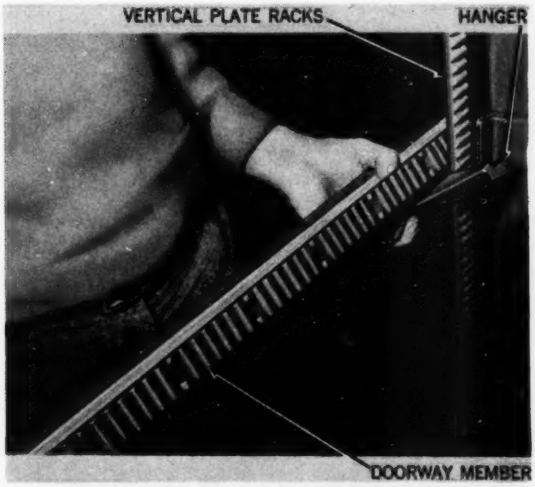


Figure 26—Doorway Member Installation—Positioning the Member

Grasp the member near both ends. Tilt and angle it into position with the hangers behind the vertical plates (fig. 26). Engage the hangers in the vertical plate racks.
NOTE: Make sure that the doorway member is level.

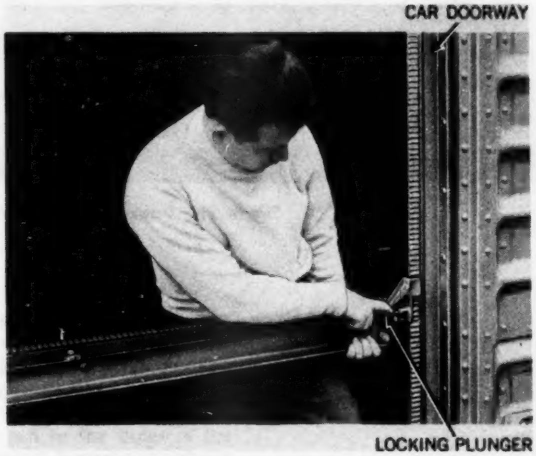


Figure 27—Doorway Member Installation—Locking the Member

Retract the plunger at each end, and turn the bottom edge of the member outward or forward to position the plungers behind the vertical plates. Release the plungers to lock the member. See figure 27.

ILLUSTRATION XI

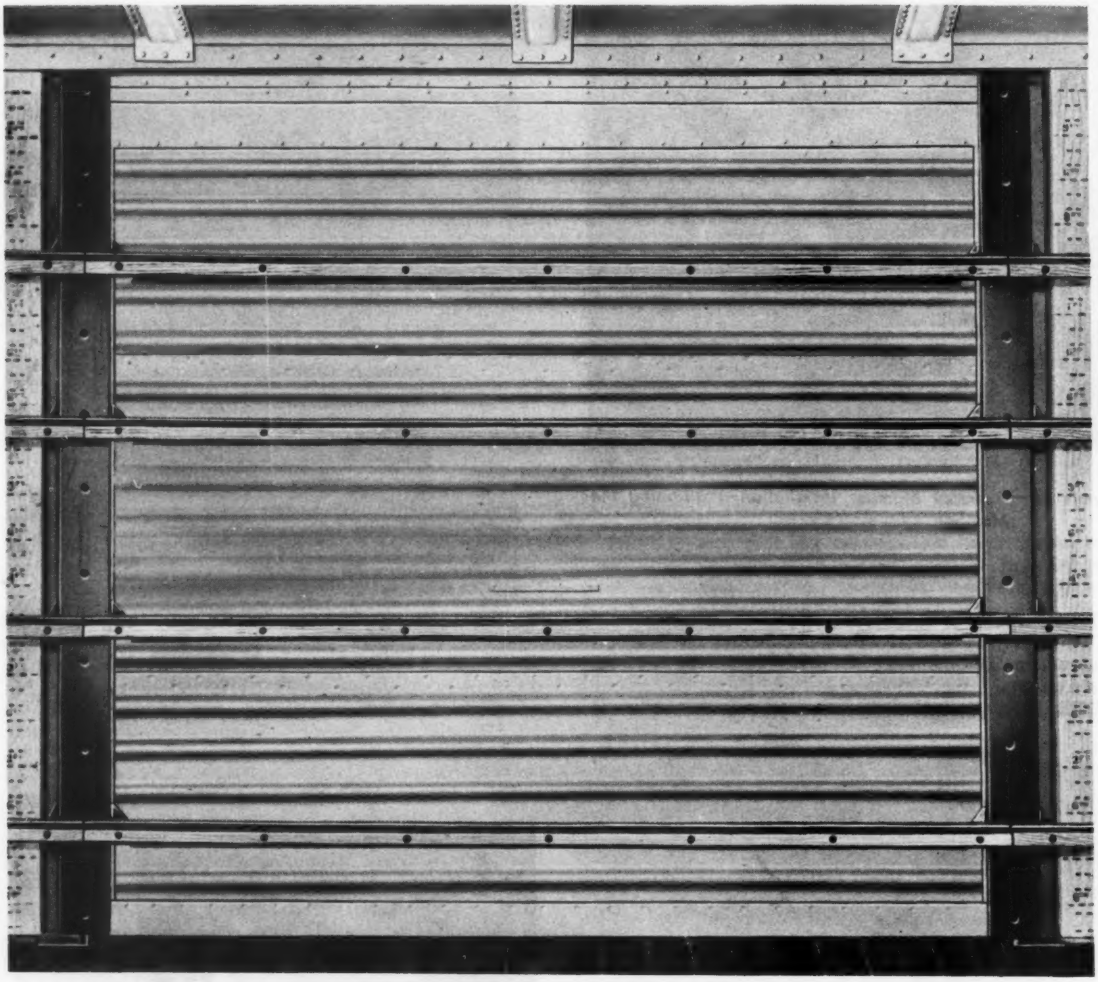


Figure 28 — Doorway Member Installation — Member in Place

Figure 28 shows the doorway members installed. Notice that installed doorway members do not prevent the car door from being closed.

ILLUSTRATION XII

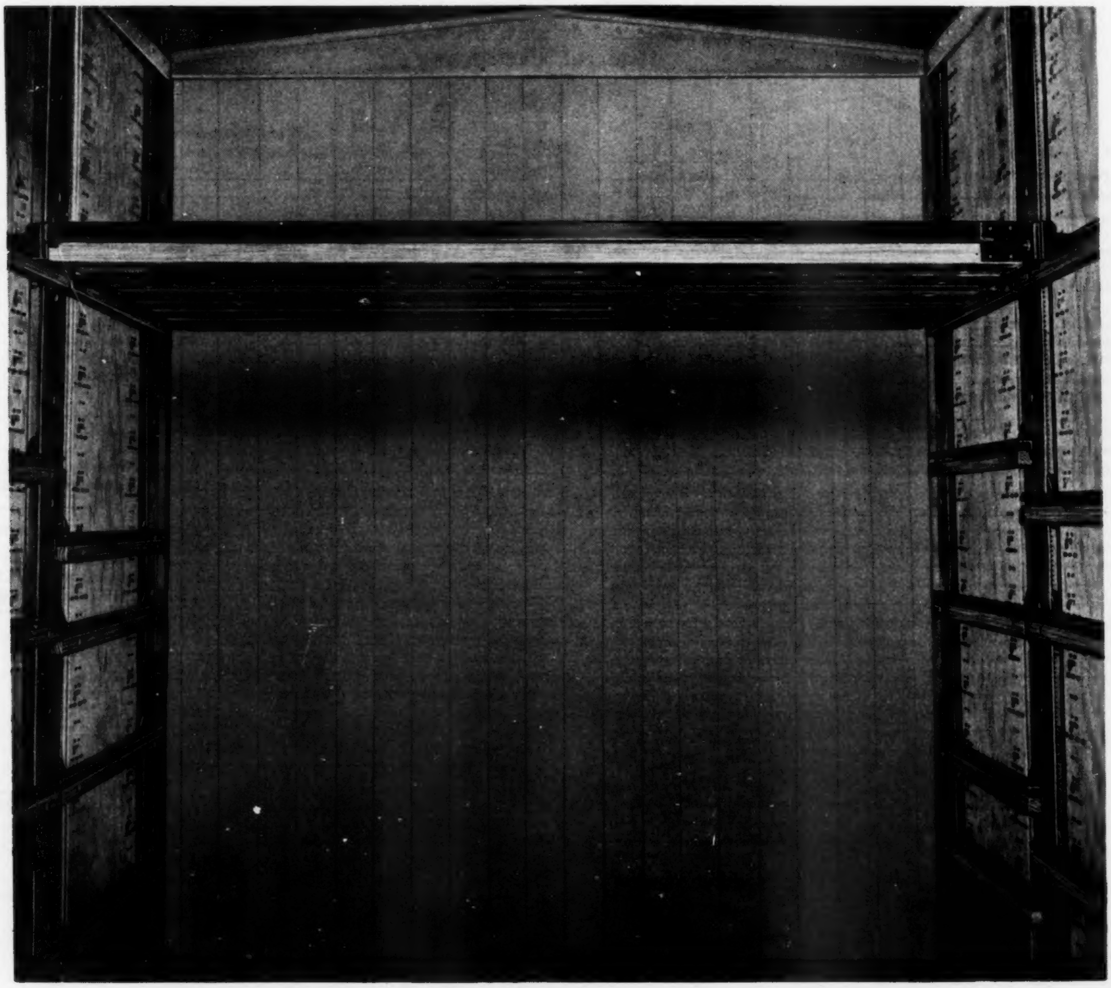


Figure 29—Storing Members Not in Use

STORING UNUSED MEMBERS

Before shipping the car, make sure that all spare cross members have been stored overhead in an out-of-the-way section of the car (fig. 29). See that unused wall members are fastened to the sides of the car and not strewn about. Unused doorway members are installed across the doorway openings.

APPLICATION I

by

Clifford Warren
Imperial Tobacco Company of Canada, Ltd.
Montreal, Canada

ELEMENT SUMMARY

REF. NO: 2-700705

PART or ACTIVITY: Molins Packer Cello Foil Machine ANALYST: CW DATE: July 3, 1958.

PRODUCT or DEPARTMENT: Change Cigarette Foil SHEET NO.____ OF____ SHEETS

ELEM. NO.	ELEMENT DESCRIPTION	Elem. Time	Freq. Per	Elem. Time Per	Const. / Var.	NOTES, VARIABLES, STD. DATA ELEM. REFERENCES SPEC. ALLOWANCES, ETC.
01	Remove holding plate			95.7		
02	Remove old foil - release drive roller - remove core.			75.5		
03	Position new foil on spindle			66.1		
04	Re-position holding plate			86.4		
05	Prepare new foil for positioning in cut-off			74.0		
06	Position the foil in the cut-off			95.8		
07	Position the foil in the leader and engage drive roller			138.0		
08	Increase tension on new roll of foil			85.8		
09	Turn to and press reset button - grasp start lever and start machine.			75.7		
				793.0	Unit	TOTAL LEVELLED TIME

DATA OR CALCULATION RECORD

CONVERSION FACTOR	
TOTAL LEVELLED TIME	
% P. F. & D. ALLOWANCE	
ALLOWANCE	
ALLOWANCE	
WORK STANDARD PER	
OUTPUT PER HR. (%)	

Form 100.

METHODS ANALYSIS CHART

REFERENCE No 2-700705

PART: Molins Combined Packer-Cello-Foil Machine. DATE: May 20/58 Elem. No: 01

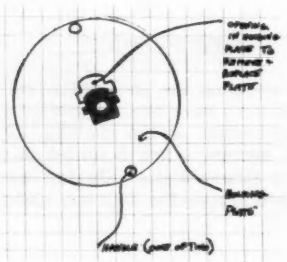
OPERATION: Change Cigarette Foil ANALYST: CW SHEET No ____ OF ____ SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
Remove Holding Plate						
			37.2	TBC2		Turn from facing the operating
Reach to the opposite handle and		R-B		~~R30Bm~~		position and reach to position
grasp		G1A	5.7	mR6B		above the unlocking handle.
			4.9	M3A		Strike the handle to unlock the
			—	G5		plate.
Hold the handle			10.6	AP2		
			3.6	M2A		Reach to and grasp
			—	RL2		the unlocking handle.
			5.4	R2A		
				T90		
			2.0	G1A		
Same as R. H.		M24B	24.3	M30B		Remove the plate and place on the
		RL1	2.0	RL1		machine frame and release.
			95.7			

The machine stops automatically as the foil runs out so that stopping the machine is only necessary when defective foil in encountered.

NO.	ELEMENT DESCRIPTION	ELEMENT TIME TMU	CONVERSION FACTOR / LEVELED TIME	% ALLOWANCE	ELEMENT TIME ALLOWED	OCCURRENCES PER PIECE OR CYCLE	TOTAL TIME ALLOWED
						TOTAL	

MTM ASSOCIATION FOR STANDARDS AND RESEARCH FORM NO.198



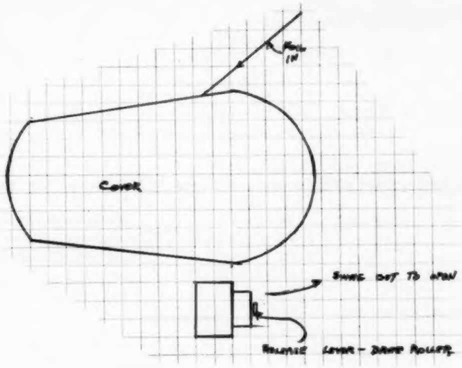
APPLICATION I

METHODS ANALYSIS CHART — Reference No 2-700705

Part: Molins Combined Packer Cello Foil Machine — Date: May 20/58 — Elem. No 02

Operation: Change Cigarette Foil — Analyst: CW — Sheet No ___ of ___ Sheets

Description — Left Hand	No	LH	TMU	RH	No	Description — Right Hand
Remove old Foil & release drive roller - Remove core						
Reach to the release lever of the		R5B	7.8	R13B		Reach to the old foil with the index
pressure roller and open		G5	—			finger extended.
		M2B10	9.0	G5		
		RL2				
			14.6	M14B		Move the foil out of the cut off
			—	RL2		section and clear of the feed roller
						Side arm motion and release.
			15.8	R16B		Reach to the old core on the spindle
			2.0	G1A		and grasp.
			24.3	M30B		Move the old core to the machine
			2.0	RL1		frame and release.
			75.5			
						Provision should be made so the
						core can be dropped in a waste
						receptical while reaching for new
						roll.



METHODS ANALYSIS CHART — Reference No 2-700705

Part: Molins Combined Packer-Cel10-Foil Machine — Date: May 20/58 — Elem. No 03

Operation: Change Cigarette Foil — Analyst: CW — Sheet No ___ of ___ Sheets

Description — Left Hand	No	LH	TMU	RH	No	Description — Right Hand
Position new foil on spindle.						
		R-B	17.2	R18B		Reach to the foil roll and
		G1A	2.0	G1A		grasp.
Same as R. H.		M18C $\frac{16}{2}$	26.5	M18C $\frac{16}{2}$		Move the foil roll to the spindle.
Same as R. H.		P1SE	5.6	P1SE		Position the roll on the spindle.
Same as R. H.		M4C $\frac{16}{2}$	12.8	M4C $\frac{16}{2}$		Move the roll to the end of the
						spindle shaft.
Same As R. H.		RL1	2.0	RL1		Release the roll.
			66.1			
						The roll will be placed on the mc.
						near the hopper with the retaining
						paper strip removed and the loose,
						end at "4 O'Clock".

METHODS ANALYSIS CHART — Reference No 2-700705

Part: Molins Combined Packer-Cello-Foil Machine. — Date: May 20/58 — Elem. No 04

Operation: Change Cigarette Foil — Analyst: CW — Sheet No ___ of ___ Sheets

Description — Left Hand	No	LH	TMU	RH	No	Description — Right Hand
Re-position Holding Plate.						
			20.1	R22B		Reach from positioning the new foil
						to the plate on the mc. frame and
			2.0	G1A		grasp the handle.
			25.5	M24C		Move the plate to the spindle.
			10.4	P1NSE		Position the plate on the spindle
						and hold.
Release the hold on a handle to		RL1	2.0			
drive the plate to the lock						
position.						
Reach out to hit handle		R3E	5.3			
Move the hand in and drive plate		M3A	4.9			
h--e to lock position		G5				
		AP2	10.6			
		M2A	3.6			
Release		RL2	2.0			
			86.4			

METHODS ANALYSIS CHART — Reference No 2-700705

Part: Molins Combined Packer-Cell0-Foil Machine — Date: May 21/58 — Elem. No 05

Operation: Change Cigarette Foil — Analyst: CW — Sheet No ___ of ___ Sheets

Description — Left Hand	No	LH	TMU	RH	No	Description — Right Hand
Prepare new foil for positioning in cut-off						
Reach to the loose end of foil &		R12B	12.9			From positioning the holding plate
grasp						maintain a grip on the far handle.
Move the foil, unwound by the		M28C	2910	M-B		Turn the real approximately ¼ turn.
by the motion of the R. H., over						
and down the far face of the cut-off to get						
the length required.						
			2.0	RL1		Release the handle
			10.1	R8B		Reach to and grasp the
			5.6	G3		foil.
Reach to the embossing rollers &		R14B	14.4	M10C		Move the foil out to the right so
place the fingers on the end of		G5	—			that the end is at the embossing
the foil to control it.						rollers.
			74.0			

METHODS ANALYSIS CHART — Reference No 2-700705

Part: Molins Combined Packer - Cellp - Foil Machine — Date: May 21/58 — Elem. No 06

Operation: Change Cigarette Foil — Analyst: CW — Sheet No ___ of ___ Sheets

Description — Left Hand	No	LH	TMU	RH	No	Description — Right Hand
Position the foil in the cut-off.						
Maintain control of the foil end.			6.9	M4B		Move the foil toward the positioning
						slot so that it makes an arc.
Regrasp the foil to prepare for		G2	5.6			
positioning.						
Move the foil to the rolls		MfC	2.0			
Position the foil between the first		P1SSD	14.7	M-B		Advance foil held in hand.
two rollers.						
Thread the foil between the rollers 5		G2	28.0	M-B		Advance hand held foil.
Release the foil		RL1	2.0			Maintain control of the foil
Reach toward the foil at the		R-Bm	29.0	B		Bend to look at the pressure roller
pressure roller assembly.						area.
Complete the reach to the foil &		MR3D	5.6			
grasp with the first two fingers		G1A	2.0			
			95.8			

APPLICATION I

ILLUSTRATION I   ILLUSTRATION II

METHODS ANALYSIS CHART

REFERENCE NO 2-700705

PART Molins Combined Packer-Cello-Foil Machine DATE May 21/58 Elem. NO 07

OPERATION Change Cigarette Foil ANALYST CW SHEET NO ___ OF ___ SHEETS

DESCRIPTION — LEFT HAND	NO	L H	TMU	R H	NO	DESCRIPTION — RIGHT HAND
Position the Foil in the Ledger.						
Regrasp the foil to obtain contact	2	G2	11.2			
for positioning						
Move the foil to the pressure		M2C	5.2			
rollers.						
Position the foil between the		P1SSD	14.7			
rollers and the ledger slot guide.						
Seat the foil in the slot guide.	4	MfC	8.0			Release contact of the upper sectio
	3	RL1	6.0	RL1		of the foil and reach to the
	3	RfB	6.0	R-B		pressure roller release lever and
	3	G1A	6.0	G5		bar.
Release the foil and move the		RL1	2.0			
hand clear		R4E	6.8			
			9.8	MfA20		Take up the tension on the release
						bar.
			10.6	AP2		Press the release lever.
Watch the foil for possible			9.3	M3A10		Control closing of the pressure
displacement.						roller.
			—	RL2		Remove the hand
			10.5	R10E		
		Total 138.0	31.9	AB		Arise from bend.
(Position after blockage – element)						
(preceeded by R14B and G1a of R.H.)						
(& L.H. and eliminates the G2 –)						
(Value – 143.2)						

METHODS ANALYSIS CHART

REFERENCE NO 2-700705

PART Molins Packer-Cello-Foil Machine DATE July 3, 1958 Elem. NO 09

OPERATION Change Cigarette Foil ANALYST CW SHEET NO ___ OF ___ SHEETS

DESCRIPTION — LEFT HAND	NO	L H	TMU	R H	NO	DESCRIPTION — RIGHT HAND
Turn to and press reset button – Grasp start lever and start Machine.						
			37.2	TBC2		Turn from foil area and reach to
				R20Bm		reset button.
			5.7	mR6B		
			10.6	AP2		Press reset button with finger.
			2.0	RL1		Release.
			10.1	R8B		Reach to start lever.
			2.0	G1A		Grasp.
			6.1	MrA		Move the lever to the ON position
			2.0	RL1		Release.
			75.7			

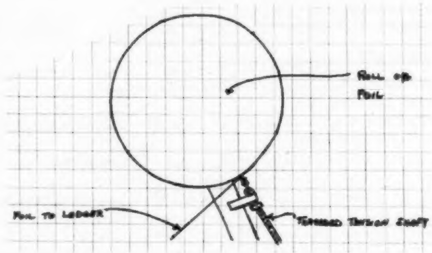
METHODS ANALYSIS CHART

REFERENCE NO 2-700705

PART Molins Packer-Cello-Foil Machine DATE May 20/58 Elem. NO 08

OPERATION Change Cigarette Foil ANALYST CW SHEET NO ___ OF ___ SHEETS

DESCRIPTION — LEFT HAND	NO	L H	TMU	R H	NO	DESCRIPTION — RIGHT HAND
Increase Tension on new roll.						
Reach to and grasp the		R10B	11.5	R-E		Reach to the general area of the
threaded spindle.		G1A	2.0			spindle.
Pull the spindle down against the		AP2	10.6			
spring		M2A5	6.0			
			4.0	R2B		Move the index finger to the nut &
			—	G5	5	spin down.
Hold spindle			28.5	M3B	5	
			—	RL2	5	
			21.2	R3B	4	
Release the spindle		RL1	2.0			
			85.8			
						Maximum requirement obscured
						(other 50% less spin down)



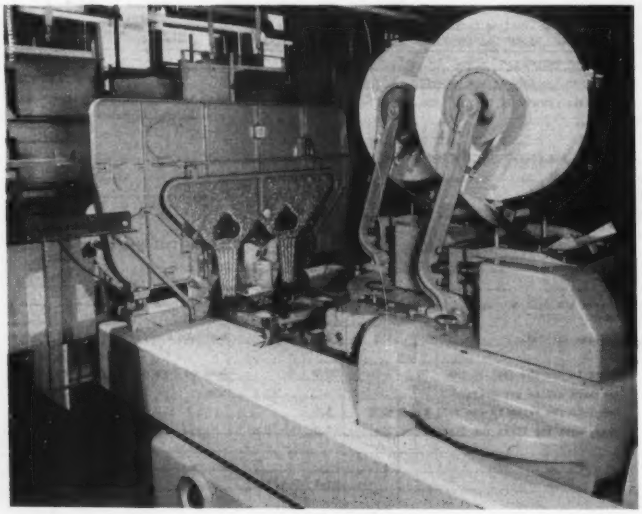


ILLUSTRATION I

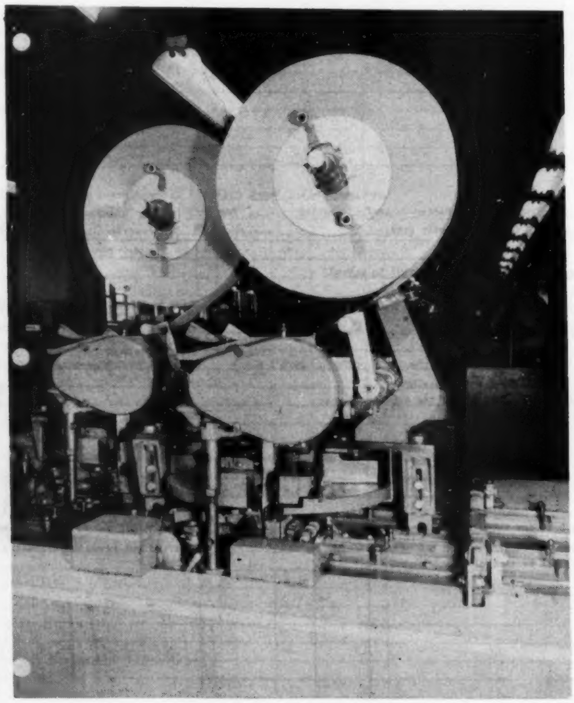


ILLUSTRATION II

APPLICATION II

by

Luciano Adami
SIAM DI TELLA LTDA.
Buenos Aires, Argentina

INDEX

I) Cost comparison report advising against introduction of proposed change in manufacturing method of drilling 2 holes in flange

A) MTM - Study No. 40-I (DIRECT OBSERVATION) of present method.

B) MTM - Study No. 40-II (VISUALIZATION) of proposed method.

CAMBIO DE METODO

(En base a sugerencia de Dirección Técnica)

PIEZA:	Brida 1508-33
OPERACION:	Agujerear 2 agujeros ∅ 9,5 mm.
METODO ACTUAL:	Se agujerea un agujero a la vez. Se utilizan: Máscara-dispositivo N°120569, taladro común, una mecha diámetro 9,5 mm., dos bandejas para suministro y depósito piezas. Tiempo standard por pieza: .00832 h (Estudio N°40-I)
METODO PROPUESTO:	Se agujerean los dos simultáneamente. Se utilizan: Dispositivo a resorte, cabezal múltiple a dos mandriles, taladro común, dos mechas diámetro ∅ 9,5 mm., dos bandejas para suministro y depósito de piezas. Tiempo standard por pieza: .00507 h (Estudio N°40-II)

AHORRO EN HORAS: .00832 - .00507 = .00325 h por pieza (corresponde al 60 %)

PRODUCCION ANUAL: 100.000 piezas

AHORRO ANUAL MANO DE OBRA DIRECTA ($ 16/h)

100.000 pzas. x .00325 h/pza. x $ 16/h = $ 5.200.-

COSTO ANUAL INSTALACION:

$ 4.500 (indicado por Jefe oficina proyecto en fecha 2-9-58).

CONCLUSION:

El costo de la nueva instalación se amortigua en

$$\frac{\$\ 4.500}{\$/\text{año}\ \ 5.200} = 0,87 \text{ años}$$

Considerando que la discontinuidad de la fabricación de esta pieza se puede producir en cualquier momento ya que se emplea en bombeadores de agua, cuya venta es muy fluctuante, aconsejamos NO introducir esta mejora de método.

Septiembre 9 de 1958.-

Sección Análisis

L. ADAMI

HOJA DE ANALISIS DE LOS METODOS

PIEZA ____ FECHA 1-9-1958 REFERENCIA Nº HD-2
OPERACION ____ ANALISTA L.ADAMI ESTUDIO Nº 40(1)
HOJA Nº 2 DE 5 HOJAS

DESCRIPCION - MANO IZQUIERDA	Nº	M I	UMT	M D	Nº	DESCRIPCION - MANO DERECHA
A) Obtener pieza						
			18,2	R45C		A bandeja
			7,1	G4A		Cojer pieza
A mano derecha		M5A	15,8	M40A		A mano izquierda
Cojer de la derecha		G3	5,6	G3		Soltar
Girar pieza para presentarla		T90S	5,4	M2A		Volver a pieza
Soltar		G3	5,6	G3		Cojer pieza de mano izq.
			57,9			
B) Colocar pieza en mascara y bloquearla						
Mano a botón de perno bloqueo		R10A	6,1			
		G1A	7,9	M10C		Pieza a mascara
			16,2	P2SE		Posicionar en perno
			2,0	MfC		Presentar extremo a
			5,6	P1SE		perno bloqueo
			2,0	MfA		Pieza a fondo
Girar botón para acercar	1	M2B	2,2			
perno de blojeo a pieza y	2	RL1	4,0			
blojear	2	R4A	6,8			
	2	G1A	4,0			
	2	M4B	8,0			
	1	AP1	16,2			
Soltar botón		RL1	2,0	RL1		Soltar pieza
			83,0			

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HOJA DE ANALISIS DE LOS METODOS

PIEZA ____ FECHA 1-9-1958 REFERENCIA Nº HD-2
OPERACION ____ ANALISTA L.ADAMI ESTUDIO Nº 40(1)
HOJA Nº 3 DE 5 HOJAS

DESCRIPCION - MANO IZQUIERDA	Nº	M I	UMT	M D	Nº	DESCRIPCION - MANO DERECHA
C) Cerrar mascara						
A brazo mascara		R12A	6,4	R10A		A botón palanca cierre
Cojer brazo		G1A	2,0	G1A		Cojer botón
Bajar brazo		M20A	9,6			
		~~T90S~~				
			4,2	M6A		Palanca cierre a tope(c.reloj)
			2,2	M2B	1	
			4,0	RL1	2	Arrimar botón de palanca
			6,8	R4A	2	cierre a brazo mascara y
			4,0	G1A	2	bloquear
			8,0	M4B	2	
			16,2	AP1	1	
Soltar brazo		RL1	2,0	RL1		Soltar botón
			65,4			
D) Poner en contacto broca con pieza						
A mascara		R6A	11,0	R50A		Mano a palanca mando broca
Cojer mascara		G1A	2,0	G1A		Cojer palanca
Mascara hacia broca		M12B	8,8	M12C		Bajar broja
Poner en linea mascara y		MfC	2,0			
Broca		P1SE	5,6			
			2,0	MfC		Broca a bujo mascara
		P1SE	5,6			
			2,3	M2C		MOver broca a pieza con
			5,6	P1SE		cuidado
			46,9			
E) Agujerear 1 agujero ∅ 9,5 mm						
			139,0	DO		Agujerear ∅ 9,5(700 Rv.)
			139,0			
F) Retirar broca de la mascara						
			5,0	M6B		Retirar broca levantando palanca
			5,0			

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RESUMEN DE LA OPERACION

PIEZA Brida 1508 - 33 FECHA 1-9-58 REFERENCIA Nº HD2
OPERACION Agujerear 2 agujeros ∅ 9,5 mm. ANALISTA L. ADAMI ESTUDIO Nº 40 (1)
(1 agujero por vez) HOJA N. 1 DE 5 HOJAS

Nº	DESCRIPCION DEL ELEMENTO	HOJA DE ANALISIS REF	TIEMPO DEL ELEMENTO UMT	FACTOR DE CONVERSION .00001 TIEMPO NIVELADO	% SUPLEMENTO	TIEMPO ELEMENTAL CONCEDIDO	REPETICIONES POR PIEZA O CICLO	TIEMPO TOTAL CONCEDIDO
A	Obtener pieza	2	57,9	.00058	15	.00067	1	.00067
B	Colocar pieza en máscara y bloquearla	2	83,0	.00083	15	.00095	1	.00095
C	Cerrar máscara	3	65,4	.00065	15	.00075	1	.00075
D	Poner en contacto broca c/pieza	3	46,9	.00047	15	.00054	1	.00054
E	Agujerear 1 agujero ∅ 9,5 mm	3	139,0	.00139	15	.00159	2	.00318
F	Retirar broca de la máscara	3	5,0	.00005	15	.00006	2	.00012
G	Poner en contacto broca c/2º lado pieza	4	26,9	.00027	15	.00031	1	.00031
H	Retirar máscara y soltar palanca	4	10,5	.00011	15	.00013	1	.00013
L	Abrir máscara	4	68,4	.00068	15	.00078	1	.00078
M	Sacar pieza y dejarla a un lado	5	77,1	.00077	15	.00089	1	.00089

TIEMPO TOTAL CONCEDIDO POR pieza .00832

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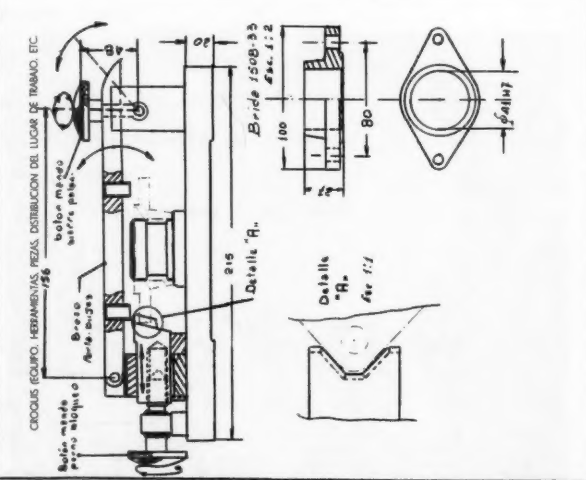
CROQUIS (EQUIPO, HERRAMIENTAS, PIEZAS, DISTRIBUCION DEL LUGAR DE TRABAJO, ETC.)



DIBUJO Nº. 1508 -33
DESCRIPCION DE LA PIEZA Brida 1508-33
MATERIAL Hº. Fdo G-106/2
OPERACION Agujerear 2 agujeros ∅ 9,5 mm
Nº. OPER. 3
SITUACION R-060
OPERARIOS
HOMBRE MUJER — NOMBRE — Nº.
EQUIPO 2 bandejas de 300x200x150 mm
1 taladro común
1 broca ∅ 9,5
HERRAMIENTAS ESPECIALES Máscara-dispositivo Nº 120569
CONDICIONES Normales
REQUISITOS DE CALIDAD Los agujeros tienen que estar bien equidistantes del centro de la pieza
ESTUDIADO POR [signature]
APROBADO POR [signature]

HOJA DE ANALISIS DE LOS METODOS

PIEZA ______
OPERACION ______
FECHA 1-[illegible]-195[illegible] REFERENCIA Nº ID-2
ANALISTA L.A[illegible] ESTUDIO Nº 40(1)
HOJA Nº 4 DE 5 HOJAS

DESCRIPCION - MANO IZQUIERDA	Nº	M I	UMT	M D	Nº	DESCRIPCION - MANO DERECHA
3) [illegible] 1a [illegible]						
[illegible]		M?G	5,8	M?G		Bajar broca
[illegible]		P1[illegible]	5,6			
			5,[illegible]	[illegible]2G		Broca abajo [illegible]
[illegible] a broca		P1SE	5,6	[illegible]2C		Bajar broca [illegible]
			5,5	P1S[illegible]		con [illegible]
			36,2			
4) Retirar broca y soltar palanca						
[illegible]		M14B	8,5	M14A		Palanca mando broca arriba
Soltar [illegible]		RL1	2,0	RL1		Soltar palanca
			10,5			
5) Abrir mascara						
[illegible]		[illegible]	9,5	R20A		A botón palanca cierre
Cojer [illegible]		G1A	2,0	G1A		Cojer palanca
			15,2	AP1		Aflojar botón
			2,2	[illegible]2B	1	
			4,0	RL1	2	
			6,8	R1A	2	Desenroscar botón
			4,0	G1A	2	
			8,0	M4B	2	
			6,1	M6A		Abrir palanca cierre
Levantar brazo		M20A	9,6			
		~~M[illegible]~~				
Soltar brazo		RL1	2,0	RL1		Soltar palanca
			68,4			

HOJA DE ANALISIS DE LOS METODOS

PIEZA ______
OPERACION ______
FECHA 1-[illegible]-195[illegible] REFERENCIA Nº ID-2
ANALISTA L.A[illegible] ESTUDIO Nº 40(1)
HOJA Nº 5 DE 5 HOJAS

DESCRIPCION - MANO IZQUIERDA	Nº	M I	UMT	M D	Nº	DESCRIPCION - MANO DERECHA
1) Sacar pieza y dejarla a un lado						
Mano a botón perno bloqueo		M12A	5,4	M10A		Mano a pieza
Cojer botón perno bloqueo		G1A	2,0	G1A		Cojer pieza
Aflojar botón		AP1	16,2			
	1	M2B	2,2			
Desenroscar botón alejando	2	RL1	4,0			
perno de bloqueo	2	R1A	6,8			
	2	G1A	4,0			
	2	M4B	8,0			
			7,5	D2E		Sacar pieza
			18,0	M10B		Pieza al deposito
Soltar botón		RL1	2,0	RL1		Soltar pieza
			77,1			

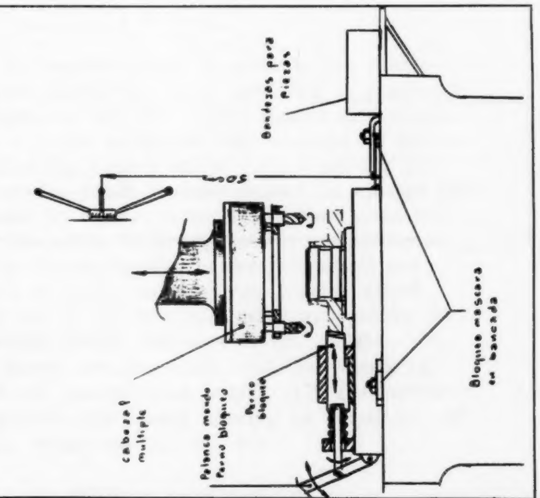
RESUMEN DE LA OPERACION

PIEZA Brida 1508-33
OPERACION Agujerear 2 agujeros ø 9,5 mm.
(simultaneamente)
FECHA 1-[illegible]-1958 REFERENCIA Nº ID-2
ANALISTA L.A[illegible] ESTUDIO Nº 40(2)
HOJA N. 1 DE 2 HOJAS

Nº	DESCRIPCION DEL ELEMENTO	HOJA DE ANALISIS REF.	TIEMPO DEL ELEMENTO UMT	FACTOR DE CONVERSION .00001 TIEMPO NIVELADO	% SUPLEMENTO	TIEMPO ELEMENTAL CONCEDIDO	REPETICIONES POR PIEZA O CICLO	TIEMPO TOTAL CONCEDIDO
A	Obtener pieza	2	57,9	.00058	15	.00067	1	.00067
B	Colocar pieza en mascara y bloquearla	2	60,8	.00061	15	.00070	1	.00070
C	Poner en contacto pieza y broca	2	30,1	.00030	15	.00035	1	.00035
D	Agujerear 2 agujeros ø 9,5 mm	2	222,0	.00222	15	.00255	1	.00255
E	Retirar broca y abrir perno bloqueo	3	27,2	.00027	15	.00031	1	.00031
F	Sacar pieza	3	42,5	.00043	15	.00049	1	.00049

TIEMPO TOTAL CONCEDIDO POR pieza .00507

CROQUIS (EQUIPO, HERRAMIENTAS, PIEZAS, DISTRIBUCION DEL LUGAR DE TRABAJO, ETC.



DIBUJO Nº 1508-33
DESCRIPCION DE LA PIEZA Brida 1508-33
MATERIAL Hº Fdo G-106/2
OPERACION Agujerear 2 agujeros ø 9,5 mm. (simultaneamente)
Nº OPER. 3
SITUACION R-060
OPERARIOS
HOMBRE MUJER | NOMBRE | Nº
EQUIPO 2 bandejas de 300x200x150 mm.
1 taladro comun
2 brocas ø 9,5 mm.
HERRAMIENTAS ESPECIALES Dispositivo de bloqueo pieza
Cabezal multiple
CONDICIONES Normales
REQUISITOS DE CALIDAD Los agujeros tienen que estar bien equidistantes del centro de la pieza
ESTUDIADO POR [signature]
APROBADO POR [signature]

APPLICATION II

HOJA DE ANALISIS DE LOS METODOS

PIEZA

OPERACION

FECHA 1-9-1958 REFERENCIA Nº HD-2
ANALISTA L. ADALI ESTUDIO Nº 40(2)
HOJA Nº 2 DE 3 HOJAS

DESCRIPCION - MANO IZQUIERDA	Nº	M I	UMT	M D	Nº	DESCRIPCION - MANO DERECHA
A) Obtener pieza						
			11,2	R50C		A bandeja
			7,3	G4A		Cojer pieza
A mano derecha		[illegible]	15,2	M40A		A mano izquierda
Cojer pieza		G3	5,6	G3		Soltar
Girar pieza para presentarla		T90S	5,4	[illegible]		Volver a pieza
Soltar		G3	5,6	G3		Cojer pieza de la izquierda
			57,2			
B) Colocar pieza en máscara y bloquearla						
Mano a palanca grande perno bloq.		R21A	[illegible]			
Cojer palanca		G1A	2,0			
Levar palanca para retirar		AP1	16,2			
perno de bloqueo		M10B	6,3	M5B		Pieza a máscara
			2,0	P1C		Pieza en perno
			15,2	P23A		
			2,0	P1C		Presentar extremo pieza al
			5,6	M13A		perno bloqueo
			[illegible]	M2A		Pieza a fondo
Mover palanca para cerrar perno		M10A	[illegible]			
Soltar palanca		RL1	2,0	RL1		Soltar pieza
			80,0			
C) Poner en contacto pieza y brocas						
			13,0	R50A		[illegible] brocas
			2,0	G1A		Cojer palanca
			9,4	M10C		Bajar brocas hasta que se
			5,6	P1SE		pongan en contacto con la pieza
			30,4			
D) Taladrar 2 agujeros Ø [illegible] mm.						
			222,0	D0		Taladrar 2 agujeros (700 ev.)
			222,0			

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HOJA DE ANALISIS DE LOS METODOS

PIEZA

OPERACION

FECHA 1-9-1958 REFERENCIA Nº HD-2
ANALISTA L. ADALI ESTUDIO Nº 40(2)
HOJA Nº 3 DE 3 HOJAS

DESCRIPCION - MANO IZQUIERDA	Nº	M I	UMT	M D	Nº	DESCRIPCION - MANO DERECHA
E) Retirar broca y abrir perno de bloqueo						
			5,0	M5B		Retirar brocas llevando
Vencer resistencia resorte		AP1	16,2	M5A		palanca a tope
Palanca hacia izquierda (abertura perno bloqueo)		M10A	6,0	RL1		Soltar palanca
			27,2			
F) Sacar pieza						
			13,0	R50A		A pieza
			2,0	G1A		Cojer pieza
			7,5	D2E		Sacar pieza de dispositivo
Palanca hacia derecha (cierre bl.)		M16A	18,0	M40B		A depósito piezas elaboradas
Soltar palanca		RL1	2,0	RL1		Soltar pieza
			42,5			

N - 344 - 10000-1-57

APPLICATION III

STANDARD DATA FOR EDGE AND FACE GLUING AT THE CLAMP CARRIER

by

George Vasiliou
Head of Standards
Brunswick-Balke-Collender Co.
Marion, Va.

Operation Description

The purpose of the gluing operation is to produce wider and/or thicker panels from smaller pieces of wood. The orientation of the annual growth rings determines the edge, face and end surfaces of a wood part (Fig. 1A).

The manner in which these wood parts are bonded together determines whether the resultant panel is termed edge-glued (Fig. 1B) or face-glued (Fig. 1C).

The operation is performed at the clamp carrier (Fig. 2). The latter consists of a mechanism for supporting and indexing the hand screw clamps which supply the pressure required to obtain a good glue joint.

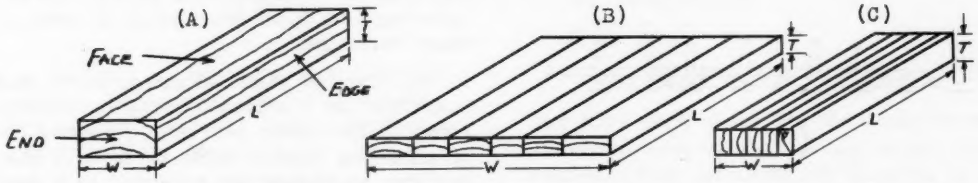


Figure 1. —Terminology for (A) wood parts, (B) edge glued panels and (C) face glued panels. W refers to width, L refers to length and T refers to thickness.

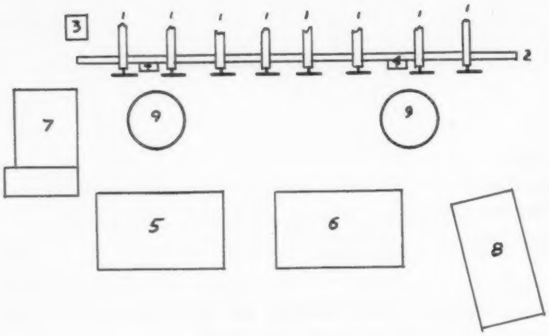
Figure 2—A clamp carrier.

The general procedure for gluing up panels at the clamp carrier is as follows: (1) The first piece of the panel is placed in the clamps. (2) The remaining pieces that will make up the panel are handled from a truck to the single roll glue spreader, where adhesive is applied to one surface. (3) The "wet" pieces are placed in the clamps, arranged edge to edge or face to face, and the ends aligned. (4) With all the parts of the panel so assembled, the clamps are tightened by hand. A mallet is then used to pound the parts flush against the clamp bars. (5) The clamp carrier is then advanced one position in order to move the freshly glued panels out of the way and make accessible the previously glued, and now dried, panels. (6) The clamps are loosened, and the panels removed and placed on a truck. (7) The operator then adjusts the clamp spacing as required and repeats steps one through six.

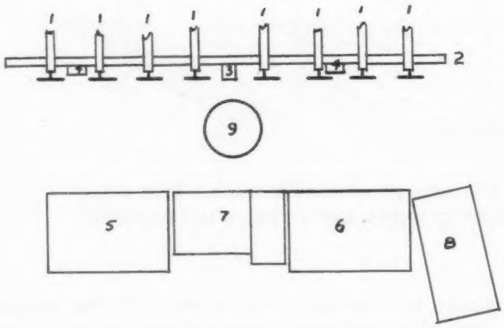
Methods Improvements

Under the original method, two men were used in gluing up panels. The glue spreader and the controls for indexing the clamp carrier were located at the side of the workplace (Fig. 3A).

A preliminary study revealed that this arrangement required a considerable amount of walking by the operators. In addition, interference and balancing of the work load resulted in lost time,



(A)



(B)

Figure 3. —Clamp carrier workplace layout, (A) for the original method, using a two-man crew with glue spreader and machine controls at side. (B) for the improved method, using one operator and with centrally located glue spreader and machine controls. Items in layout as follows: clamps (1), clamp support bar (2), machine controls (3), mallets (4), wood parts (5), glued up panels (6), glue spreader (7), extra pipe clamps (8), and operators (9).

due to the operators waiting on each other at various points in the cycle. A new method was developed, based on changing over to a one-man operation and also moving the glue spreader and machine controls to the center of the workplace (Fig. 3B). Check studies confirmed that the new arrangement reduced the gluing man-hours per panel.

Gluing Specifications

The time required to glue up a panel depends, in part, upon (a) the number of clamps per section, (b) the maximum total width of parts that can be placed in the clamps, and (c) the number of pieces that can be handled at one time when applying the adhesive.

Before the appropriate motion patterns could be developed, it was necessary to investigate each of these factors. The resulting specifications for gluing work at the clamp carrier are set forth in Fig. 4.

Master List of Elements

The gluing of rectangular panels was next studied for the purpose of compiling a master list of elements. This classification (Fig. 5) was developed in such a manner as to permit combining the elements in various sequences that would encompass all the significant variables encountered in clamp carrier work. The following is a brief description of some of these variables.

(1) Type of stock. —Random width stock is "matched" as a separate operation before arriving at the clamp carrier. Matching consists of arranging various width parts on a saw table and then machining the assembly to a specific width. Definite width stock is not matched before gluing, as width and thickness of the individual parts are fixed. Thus the clamp carrier operator handles the first piece of matched panels one at a time to the clamps, while he can handle as many of the definite width pieces to the clamps at one time as there are panels per section.

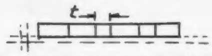
(2) Pieces per bundle. —The elements of turning stock on edge and arranging pieces in the clamps are developed for two, three, or four pieces per bundle.

(3) Clamps per section. —Elements covering tightening and loosening of clamps are classified in terms of two, three or four clamps per section. In addition, separate elements cover handling an extra removable pipe clamp.

(4) Distance. —Elements including walking were developed in terms of distance. The latter (determined by observation and measurement from a scaled workplace layout) refers to the difference in distance between the location of the operator at the start and at the end of the element, and not the distance the part travels in being handled during the element.

A coding system was used to indicate the general type and sequence of elements. W refers to walking elements. H. U. refers to work where the operator is handling parts up to the clamps. L. U. deals with elements where the

Panel Length	Clamps /Sect	Sections /turn
14" to - 20"	2	4
20" to - 42"	3	3
42" to - 57"	4	2
57" to - 72"	5	2

Clamp Capacity	
	
t	W max
up to 1"	28"
more than 1"	32"

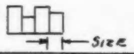
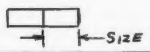
Pieces Per Handful (H)			
			
Size	H	Size	H
4/4	4	1 to 1-1/8	4
5/4	3	1-3/16 to 1-5/8	3
6/4	3	1-11/16 to 2-1/4	2
8/4	2		

Figure 4. —Clamp carrier gluing specifications.

operator is laying up the parts in the clamps. H. D. pertains to removing the dried panels from the clamps. Process type elements (machine controlled) are identified by a P.

Elemental Time Values

Elemental time values were developed through the use of the MTM procedure. Eight typical motion patterns have been included in this article.

Occurrence Studies

The frequency of occurrence of most of the elements was automatically established when the gluing specifications and methods were determined. However, occurrence studies were required for the few elements whose frequency depended upon material characteristics or product mix. Examples are the number of mallet blows required per section and the occurrence of placing and asiding extra pipe clamps.

Work Sheet For Rate Setting

The final work sheet was developed from the elemental time values and the proper occurrences. Two examples are included to illustrate typical standards calculations for edge-glued and face-glued panels. The advantages of such a work sheet are as follows:

(1) It permits the rapid setting of accurate, consistent standards.

(2) All the time values required to set the standard appear on the work sheet.

(3) Decision making is not required of the rate setter. Knowledge of the panel size and use of the gluing specifications reduces the setting of standards to a series of simple calculations.

(4) The work sheet itself is a record of the general method on which the standard is based. It shows the elements of work, their sequence, and the time allowed for the major element groupings.

Element No.	Element Description	Normal Minutes	Per	Source
W	Travel from truck to support bar or from bar to truck	.0250 + .00438D'	trip	MTM-1
HU-1	Travel from bar to truck and offset panel of random width parts	.0415 + .00438D'	trip	MTM-2
HU-2	Grasp 1 random with piece; travel from truck to bar and place pc in clamps	.0392 + .00438D'	trip	MTM-3
HU-3	Grasp stack of dry pieces for def. width panel	.0178	stack	MTM-4
HU-4	Travel from truck to bar; place 1 def. width pc in clamp and rest of bundle behind back stops	.0775 + .00438D'	trip	MTM-5
HU-5	Grasp 2, 3, or 4 def. width pieces for spreading glue	.0286	bdle	MTM-6
HU-6	Turn X random width pieces on edge at truck: 2 pcs	.0284	elem	MTM-7
	3 pcs	.0425	elem	MTM-8
	4 pcs	.0560	elem	MTM-9
HU-7	Position bundle at glue spreader	.0145	bdle	MTM-10
P-1	Spread glue on bundle	.00078L"	bdle	Time St.
LU-1	Arrange X wet pieces in clamp: 2 pcs	.0247	elem	MTM-11
	3 pcs	.0324	elem	MTM-12
	4 pcs	.0389	elem	MTM-13
LU-2	Bring 1 def. width piece from behind back stop and arrange in panel.	.0289	elem	MTM-14
LU-3	Align ends of ind. pcs of panel in clamp	.0107	joint	MTM-15
LU-4	Move back stop against panel edge	.0268	elem	MTM-16
LU-5	Tighten X clamps: 2 clamps	.1865	elem	MTM-17
	3 clamps	.2760	elem	MTM-18
	4 clamps	.3660	elem	MTM-19
LU-6	Pick up and aside mallet	.0430	elem	MTM-20
LU-7	Pound Joints	.0141	blow	MTM-21
LU-8	Final tightening of X clamps: 2 clamps	.0717	elem	MTM-22
	3 clamps	.0990	elem	MTM-23
	4 clamps	.1260	elem	MTM-24
P-2	Turn reel	.2228	elem	Time St.
LU-9	Get and place 1 extra pipe clamp, going from 2 or 4 sects to 3 sects.	.2292	clamp	MTM-25
LU-10	Get and place 1 extra pipe clamp, going from 3 sects. to 3 sects.	.1098	clamp	MTM-26
HD-1	Loosen clamp	.0591	clamp	MTM-27
HD-2	Loosen and aside extra pipe clamp, going from 3 sects. to 2 or 4 sects.	.1118	clamp	MTM-28
HD-3	Loosen and aside extra pipe clamp, going from 3 sects. to 3 sects.	.0594	clamp	MTM-29

Figure 5—Master list of elements for clamp carrier.

Element No.	Element Description	Normal Minutes	Per	Source
HD-4	Break out & gather panels from 1 sect.			
	1 panel	.0152	elem	MTM-30
	2 panels	.0460	elem	MTM-31
	3 panels	.0549	elem	MTM-32
	4 panels	.0697	elem	MTM-33
	5 panels	.0845	elem	MTM-34
	6 panels	.1015	elem	MTM-35
	7 panels	.1185	elem	MTM-36
HD-5	Place panels on truck	.0303	elem	MTM-37
HD-6	Adjust clamp spacing and back stop.	.0691	clamp	MTM-38

Figure 6—Master list of elements for clamp carrier, cont'd.

APPLICATION III

METHODS ANALYSIS CHART

REFERENCE No. HU-6
PART ____ DATE 1-7-59 STUDY No. 7
OPERATION Turn 2 pcs of random width parts on edge* ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
faces of 2nd piece		G1A	2.0	G1A		faces of 1st piece
turn piece on edge		M3B-3	8.2	M3B-3		turn pc on edge
slide pieces together		R1E	2.4	R1E		slide pieces together
as move thumb out of way		~~MFK~~	—	~~MFA~~		as move thumb out of way
Align ends, approx.		MfC	2.0			
		RL-1	2.0	RL-1		
			5.3	R3B		to end of both pieces
			2.0	GIA		both pieces
Towards center of pieces		R10B	14.6	M14B		pull-slide towards body
both pieces		G1A	2.0			
level load prior to move to spreader		M4B	6.9			
			47.4			
		X	.0006			
			.02844	normal minutes.		

*reach to parts internal to previous walk element

METHODS ANALYSIS CHART

REFERENCE No. LU-1
PART ____ DATE 1-7-59 STUDY No. 11
OPERATION Arrange 2 wet pcs into panel at clamp ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
Slide bdle to dry pc		M1C	3.4	M1C		slide bdle to dry pc
		RL-1	2.0			
to other end of top pc		R10B	11.5			
top pc of bdle		G1A	2.0			
			11.2	G2	2	shift finger to toppiece
top piece to clamp		M3B	5.7	M3B		top piece to clamp
slide pc to btm pc		M1C1	3.4	M1C1		slide pc to btm pc
		RL-1	2.0	RL-1		
			41.2			
		X	.0006			
			.02472	normal minutes		

METHODS ANALYSIS CHART

REFERENCE No. LU-4
PART ____ DATE 1-8-59 STUDY No. 16
OPERATION Move back stop against panel edge ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
to clamp handle		R10B	24.4	R28B		to bk stop, from frt pc
		G1A	2.0	G1A		
			4.3	MfA-5		release catch
			12.0	M5A-10		slide bk stop to panel
		RL-1	2.0	RL-1		
			44.7			
		X	.0006			
			.0268	Normal minutes.		

METHODS ANALYSIS CHART

REFERENCE No. LU-6
PART ____ DATE 1-8-59 STUDY No. 20
OPERATION Get and aside mallet for pounding ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
			21.5	R24B		to mallet handle
			2.0	G1A		
			20.6	M24B		move mallet to section
						POUND TIME (see LU-7)
			25.5	M24C		return mallet to box
			2.0	RL-1		
			71.6			
		X	.0006			
			.04296	normal minutes		

METHODS ANALYSIS CHART

REFERENCE No. LU-7
PART ____ DATE 1-8-59 STUDY No. 21
OPERATION Pound section (per blow) ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
			12.2	M16B		raise mallet
			11.3	M10A		strike blow
			23.5			
		X	.0006			
			.01410	normal minutes/blow		

METHODS ANALYSIS CHART

REFERENCE No. LU-8
PART ____ DATE 1-9-59 STUDY No. 22
OPERATION Final tighten (2 clamps/section) ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
towards clamps		R4E	12.2	M16B		lay mallet on section
			2.0	RL-1		
to clamp handle (palm up)		R12B	12.9	R12B		to clamp handle
		~~290~~	—			
		G1A	2.0	G1A		
½ turn for final tighten		M8A-40	28.3	M8A-40		½ turn for final tighten
		RL-1	2.0	RL-1		
to second clamp		R12B	12.9	R12B		to second clamp
		~~1180~~	—	~~1140~~		
grasp handle		G1A	2.0	G1A		grasp handle
½ turn for final tighten		M8A-40	28.3	M8A-40		½ turn for final tighten
		RL-1	2.0	RL-1		
			12.9	R12B		back to mallet
			2.0	G1A		mallet handle
			119.5			
		X	.0006			
			.07170	normal minutes		

METHODS ANALYSIS CHART

REFERENCE No. HD-4
PART ____ DATE 1-10-59 STUDY No. 31
OPERATION Break out and gather 2 panels from 1 section ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
to first panel		R10B	11.5	R10B		to first panel in section
grasp end		G1A	2.0	G1A		grasp end
break out		D2D	11.8	D2D		break out
panel back to clamp		M8B	10.6	M8B		panel back to clamp
		RL-1	2.0	RL-1		
to second panel		R12B	12.9	R12B		to second panel in section
		G1A	2.0	G1A		
second panel atop first		M12B	13.4	M12B		second panel atop first
		RL-1	2.0	RL-1		
to edge of panels		R4B	6.4	R4B		to edge of panels
grasp both panels		G1A	2.0	G1A		grasp both panels
			76.6			
		X	.0006			
			.04596			

METHODS ANALYSIS CHART

REFERENCE No. HD-6
PART ____ DATE 1-10-59 STUDY No. 38
OPERATION Adjust spacing & bk. stop (1 clamp) ANALYST G.V. SHEET No. 1 OF 1 SHEETS

DESCRIPTION — LEFT HAND	No.	L H	TMU	R H	No.	DESCRIPTION — RIGHT HAND
towards end of clamp		R12B	17.2	R12B		to clamp handle
		G1A	2.0	G1A		
			11.6	M4B-10		lift up end of clamp
slide bar over		M6C-10	15.3			
		RL-1	2.0			
hit bar twice with hand,	2	R6E	16.0			
to relocate clamp	2	M6A	16.2			
	1	R2E	3.8			
to back stop		R8B	10.1	M4A-10		lower end to bar
		G1A	2.0			
release catch on back stop		MfA-5	4.3			
slide back stop		M5B-10	12.8			
release back stop		RL-1	2.0	RL-1		release handle
			115.2			
		X	.0006			
			.06912			

WORK SHEET - CLAMP CARRIER

DATE 4-4-59

PART NO. 7000 OPER NO 59 PART NAME SIDE PANEL WOOD H.M.

PANEL TYPE: MATCHED, NOT MATCHED PIECE TYPE: DEF WIDTH, RANDOM WIDTH, SCRAP

PARTS: 46 x R.W. x 4/4 BLANK SIZE 46 x 12½ x 4/4

PCS PER PANEL = N = 5 WET PCS PER PANEL = N-1 = W = 4

PANELS PER SECTION = Q = 2 CLAMPS PER SECT = C = 4 SECT PER TURN = S = 2

H = PCS PER HANDFUL = 4

GLUE-UP

											PER PANEL
DRY PIECE	SINGLE HANDLING = .099 MIN / PANEL										
	MULTIPLE HANDLING	Q	2	3	4	5	6	7	8	9	10	.099
		TIME/PANEL	.089	.068	.056	.053	.047	.046	.044	.042	.041	

WET TRIP TIME	PCS PER HAND FUL	TURN 90° Time Per Trip	No. of Trips	Time Panel	NO TURN 90° Time Per Trip	No. of Trips	Time Panel
	1	.160 + .00078 L" =			.155 + .00078L" =		
	2	.193 + " =			.172 + " =		
TRIPS/PANEL	3	.214 + " =			.200 + " =		
$= \frac{W}{H} = \frac{4}{4} = 1$	4	.234 + " = .270	1	.270	.206 + " =		
		TOTAL		.270	TOTAL		

PER PANEL: .270

ALIGN TIME							
WQ	MIN	WQ	MIN	WQ	MIN	WQ	MIN
3	.032	11	.118	19	.20	27	.281
4	.043	12	.128	20	.214	28	.300
5	.054	13	.137	21	.225	29	.310
6	.064	14	.150	22	.236	30	.321
7	.075	15	.161	23	.246	31	.342
8	.085	16	.171	24	.257	32	.364
9	.076	17	.182	25	.268	33	.385
10	.107	18	.193	26	.278	34	.401

POUND SECTION TIME

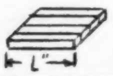
NQ	CLAMPS PER SECTION 2	3	4
8	.155	.211	.267
10	.183	.253	.323
12	.211	.295	.379
14	.237	.337	.435
16	.267	.379	.491
18	.295	.421	.555
20	.323	.463	.603
22	.358	.505	.660
24	.379	.555	.715
26	.407	.587	.773
28	.435	.631	.828
30	.463	.673	.883
32	.491	.715	.937
34	.517	.758	.996
36	.555	.800	1.053

ALIGN, CLAMP, POUND 1 SECTION			
ELEMENT	CLAMPS/SECT 2	3	4
ALIGN WQ JOINTS			.086
TIGHTEN CLAMPS	.240	.356	.473
POUND SECTION			.323
FINAL TIGHTENING	.072	.097	.126
EXTRA CLAMP: $\frac{.141 \times \text{SECT REQ CLAMP}}{3}$ =			
TIME PER SECTION			1.008
÷ Q = TIME PER PANEL			.504

PER PANEL: .504

TURN REEL = .223/QS = .223/4 = .056

REPLENISH GLUE



TIME PER PANEL = L" × Th" × WQ × .000044
= (46)(1.0)(4) × .000044 = .008

TAKE-OUT

PANELS	TIME
1	.015
2	.046
3	.065
4	.070
5	.086
6	.102
7	.119

ELEMENT	1 TRIP/SECT S=2	S=3	S=4	2 TRIPS/SECT S=2	S=3	S=4	3 TRIPS/SECT S=2	S=3	S=4
TAKE OUT + ADJUST	.636	.667	.382	.764	.595	.510	.892	.723	.638
EXTRA CLAMP: $\frac{.072 \times \text{SECTS REQ CLAMP}}{S}$ =									
BRK OUT 1 TRIP: (TIME) × 1	.046								
" " 2 ": (TIME) × 2									
" " 3 ": (TIME) × 3									
TOTAL TIME PER SECT	.682								
÷ Q = TIME PER PANEL	.341								

PER PANEL: .341

NOR MIN PER PANEL	1.278
NOR MIN + 12% = STD MIN PER PANEL	1.431
STD HOURS PER PANEL	.0238
PANELS PER HOUR	42

CHART #59-1
G.V.

WORK SHEET - CLAMP CARRIER

DATE ~~4~~-4-59

PART No. 7007 OPER No 59 PART NAME END PANEL WOOD H.M.

PANEL TYPE: MATCHED, NOT MATCHED PIECE TYPE: DEF WIDTH, RANDOM WIDTH, SCRAP

PARTS: 18 x 1½ x 13/16 BLANK SIZE 18 x 6½ x 1½

PCS PER PANEL = N = 8 WET PCS PER PANEL = N-1 = W = 7

PANELS PER SECTION = Q = 4 CLAMPS PER SECT = C = 2 SECT PER TURN = S = 4

H = PCS PER HANDFUL = 3

1½ ③

GLUE-UP

DRY PIECE												PER PANEL
SINGLE HANDLING = .097 MIN/PANEL												
MULTIPLE HANDLING	Q	2	3	4	5	6	7	8	9	10		
	TIME/PANEL	.083	.068	.056	.053	.049	.046	.044	.042	.041		.056

WET TRIP TIME

TRIPS/PANEL $= \frac{W}{H} = \frac{7}{3} = 2+$

PCS PER HND FUL	TURN 90° Time Per Trip	No of Trips	Time/Panel	NO TURN 90° Time Per Trip		No of Trips	Time/Panel
1	.160 + .00078L" =			.135 + .00078L" =	.169	1	.169
2	.173 + " =			.172 + " =			
3	.214 + " =			.200 + " =	.214	2	.428
4	.234 + " =			.206 + " =			
	TOTAL			TOTAL			.597

PER PANEL: .597

ALIGN TIME

WQ	MIN	WQ	MIN	WQ	MIN	WQ	MIN
3	.032	11	.118	19	.203	27	.281
4	.043	12	.128	20	.214	28	.300
5	.054	13	.137	21	.225	29	.310
6	.064	14	.150	22	.236	30	.321
7	.075	15	.161	23	.246	31	.332
8	.086	16	.171	24	.257	32	.364
9	.096	17	.182	25	.268	33	.355
10	.107	18	.193	26	.278	34	.404

POUND SECTION TIME

NQ	CLAMPS PER SECTION 2	3	4
8	.155	.211	.267
10	.183	.253	.323
12	.211	.295	.379
14	.239	.337	.435
16	.267	.379	.491
18	.295	.421	.555
20	.323	.463	.603
22	.358	.505	.660
24	.379	.555	.715
26	.407	.587	.773
28	.435	.631	.828
30	.463	.673	.883
32	.491	.715	.939
34	.519	.758	.996
36	.555	.800	1.053

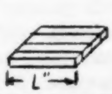
ALIGN, CLAMP, POUND 1 SECTION

ELEMENT	CLAMPS/SECT 2	3	4
ALIGN WQ JOINTS	.300		
TIGHTEN CLAMPS	.240	.356	.473
POUND SECTION	.491		
FINAL TIGHTENING	.072	.097	.126
EXTRA CLAMP $\frac{.141 \times \text{SECT REQ CLAMP}}{3} =$			
TIME PER SECTION	1.103		
÷ Q = TIME PER PANEL	.276		

PER PANEL: .276

TURN REEL = .223/QS = .223/16 = .014

REPLENISH GLUE



TIME PER PANEL
= L" × Th" × W × .000044
= (18)(1½)(7) × .000044

PER PANEL: .008

TAKE-OUT

PANELS	TIME
1	.015
2	.046
3	.065
4	.070
5	.086
6	.102
7	.119

ELEMENT	1 TRIP/SECT S=2	S=3	S=4	2 TRIPS/SECT S=2	S=3	S=4	3 TRIPS/SECT S=2	S=3	S=4
TAKE OUT + ADJUST	.636	.467	.382	.764	.595	.510	.892	.723	.638
EXTRA CLAMP $\frac{.072 \times \text{SECTS REQ CLAMP}}{S} =$									
BRK OUT 1 TRIP: (TIME) x 1			.070						
2 " : (TIME) x 2									
3 " : (TIME) x 3									
TOTAL TIME PER SECT			.452						
÷ Q = TIME PER PANEL			.113						

PER PANEL: .113

NOR MIN PER PANEL	1.064
NOR MIN + 12% = STD MIN PER PANEL	1.192
STD HOURS PER PANEL	.0198
PANELS PER HOUR	50

CHART #59-1
G.V.

I. Reprinted from "The Prospector", February 13, 1959
U.S. Marine Corps Supply Center
Barstow, California

THREE WEEKS MTM COURSE

BY

D. W. DeVOSS PLANNED

D. W. DeVoss measures the motion while Miss Susan Krouser moves and positions a dowling which is part of the MTM course exercise kit.

D. W. DeVoss, Head, Management Engineering Branch, recently attended a course in Methods-Time Measurement (MTM), sponsored by the Bureau of Ordnance, U.S. Navy, conducted by an approved instructor of the MTM Association. Having successfully completed this comprehensive course, Mr. DeVoss received a license as an applicator of MTM, approved by the Association for Standards and Research.

Methods-Time Measurement is a procedure which analyzes any manual operation or method into basic motions required to perform it and assigns to each motion a predetermined time standard which is governed by the nature of the motion and the conditions under which it is made. This technique results in detailed analysis of methods used, and provides accurate time values without the use of stop watch time studies. The uses to which MTM has been put are almost infinite in scope. To mention just a few, they include—improvement of existing methods, cost estimating, operator training, selecting effective equipment, establishing time standards and training supervisors to become methods conscious.

At present, Mr. DeVoss is meeting the requirements for his instructor's certificate from the National MTM Association. It is planned to give a three-weeks training course in the application of methods-time measurement under his instruction. This course is tentatively set for late March or early April of this year. It will be conducted under the official authority of the MTM Association and those successfully passing the final examination furnished by the MTM Association will be licensed applicators of Methods-Time Measurement.

The picture on this page illustrates a vital part of the instruction given. Each student will be furnished a kit with which he will practice and measure simulated operations of productive work. These operations will include the recognized eight manual movements, nine pedal and trunk movements and two ocular movements. The basic element "reach" will be studied as it occurs in all operations; the element "move" will be analyzed as it applies to transporting an object to a destination; the element "position" will be demonstrated in all its phases when one object is aligned, oriented and engaged with another object. All other recognized movements will be thoroughly studied in like manner.

Development of engineered time standards is now being accomplished here at the Supply Center by application of time measured units in accordance with methods-time measurement techniques. These standards have been developed and installed in the Issue Section, Storage Branch, and have proved very effective. The analysts developing these standards have not received formal training and as a result, some minor inaccuracies exist. The proposed training course approved by the MTM Association for Standards and Research will allow MTM to be applied with professional competence and make standards accurate to within 2%.

II. Reprinted from "The Brookley Spotlight", March 5, 1959
Mobile Air Materiel Area
Mobile, Alabama

ENGINEERING GROUP—Members of the National Training Committee of the Method Time Measurement Association are shown in a recent meeting at Brookley. Seated (left to right) are Jerome Goldman of Maintenance Industrial Engineering, Chairman of the Committee, C. H. Brauer of Kelly AFB, and standing (left to right), H. J. Hansen of A. T. Kearney & Company, Chicago and Richard F. Stoll, Executive Secretary of the MTM Association, Ann Arbor, Michigan

MTM GROUP HAS MEET HERE

Meeting at Brookley Air Force Base Friday, February 20, were members of the National Training Committee of the Method Time Measurement Association, a professional international measurement society.

The Association, which has representatives from all types of industry, is the only professional engineering organization to which the Air Force is allowed to belong, according to Jerome Goldman, Chairman of the Training Committee.

"MTM is a technique which results in cost reductions, aids in production increases, and gives predetermined time values for all manual motions," Goldman, of Maintenance Industrial Engineering, said.

The special meeting was called for the purpose of revising the MTM application training examination, the Chairman said.

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RESEARCH REPORTS

R.R. 101 Disengage

This report contains a preliminary study of the element disengage. While it is still classified as tentative, the report contains some extremely interesting conclusions on the nature and theory of this element.

R.R. 102 Reading Operations

The first step in the use of MTM for establishing reading time standards is contained in this report. In addition, the report contains a synopsis of the work done in this field by 11 leading authorities.

R.R. 104 MTM Analysis of Performance Rating Systems

A talk presented at the SAM-ASME Time and Motion Study Conference, April 1952. It contains an analysis of performance rating systems and various performance Rating Films from an MTM standpoint.

R.R. 105 Simultaneous Motions

This report represents almost two man-year's work on a study of Simultaneous Motions. It is a final report of the Simultaneous Motions project undertaken by the MTM Association. While it does not purport to provide complete and exhaustive answers to all problems in the field of Simultaneous Motions, it presents a great deal of new and valuable information which should be of interest to every MTM practitioner.

R.R. 106 Short Reaches and Moves

This report contains an analysis of the characteristics of Reaches and Moves at very short distances. It develops important conclusions concerning the application of MTM to operations involving these short distance elements.

R.R. 107 A Research Methods Manual

The research activity of the Association has developed an effective and comprehensive set of methods for carrying on research in human motions. This report details the major techniques used. Adequate sources of motion data, film analysis, data recording, and statistical methods of analysis are among the topics discussed.

R.R. 108 A Study of Arm Movements Involving Weight

In this report, the results of a large investigation into the effect of weight on the performance times of arm movements are presented. While more effective means of determining correct time allowances for moving weights are given, the comprehensive discussion of the whole area of weight phenomena is probably of more fundamental importance. The effect of such conditions of performance as the use of one or two hands, sliding vs. spatial movements, and male and female performance are among the topics presented.

R.R. 109 A Study of Positioning Movements

I. The General Characteristics. II. Appendix.
This report, the first of two position reports, defines "positioning movements and the interrelation of component movements." The study is limited to the laboratory analysis, and contains an appendix dealing with several subjects outside the major objectives.

R.R. 110 A Study of Positioning Movements

III. Application to Industrial Work Measurement.
This report, the second on position, relates the results of the position research to the field of application. This study deals with actual industrial operators and work measurement tools, and the evolution of an improved and more efficient technique for controlling and improving manual activity through better understanding of positioning movements.

MTM

JOURNAL REPORT